As of July 21, 2017, twenty-nine (29) SCD’s have been revised.

The Index Sheets for the SCD’s have been updated as well.

The updated publication and the separate revision package, which includes a Revision Log, are available from the ODOT Design Reference Resource Center, or from the Office of Roadway Engineering’s website. The revision package includes a detailed Revision Log.

Per ODOT policy, paper copies of the publications are no longer distributed to all holders. Revisions will only be available via the web pages noted above.

For questions, comments, or concerns please contact either:

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or,

Scott Roeder, P.E., Traffic Standards Engineer
614-752-6109, or Scott.Roeder@dot.ohio.gov
Intentionally blank
The following changes were made to the Traffic Standard Construction Drawings and Plan Insert Sheets:

<table>
<thead>
<tr>
<th>Drawing Number</th>
<th>Title</th>
<th>Revision Type</th>
<th>Revision Description</th>
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</thead>
<tbody>
<tr>
<td>HL-10.11</td>
<td>Light Pole Styles</td>
<td>Change</td>
<td>• Modified luminaire – flattened body - to more accurately depict manufacturing trends. In Post Top Decorative Lantern detail, changed “Casting” to “Coating” (two places). In Post Top Rest Area detail, changed “Typical Pole-Top Luminaire…” to “Typical Post-Top Luminaire…”</td>
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<tr>
<td>Page</td>
<td>Change</td>
<td>Description</td>
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<td>HL-50.21</td>
<td>Structure Grounding</td>
<td>Change</td>
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<tr>
<td>HL-60.11</td>
<td>Pole Wiring I</td>
<td>Change</td>
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<td>HL-60.31</td>
<td>Control Center Wiring</td>
<td>Change</td>
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<td>TC-21.10</td>
<td>Sign Support Foundation</td>
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<td>TC-21.20</td>
<td>Foundations</td>
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<td>TC-52.20</td>
<td>Sign Blank Details II</td>
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<td>TC-65.11</td>
<td>Raised Pavement Marker Spacing Details</td>
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<td>TC-73.20</td>
<td>Enhanced Wrong-Way Traffic Control for Ramps</td>
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<td>TC-83.20</td>
<td>Cabinet Foundations and Pedestals</td>
<td>Change</td>
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<tr>
<td>TC-85.10</td>
<td>Pole Mountings for Signal Heads</td>
<td>Change</td>
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- Added "(Note 11)" to Pull Box Grounding label and re-located its arrow.
- Added Note "Use UL listed devices for all structure grounding connections, when listed devices are commercially available." to all 4 sheets. On sheet 4, Grounding Plate Details schematic, deleted "(See Note 2)."
- Modified Note 3, paragraph 3. Added "Grounding Conductor" label to all 4 schematics. Revised other "Grounding Conductor" labels to "Grounding Electrode Conductor". Revised titles of both top and bottom pair of schematics.
- Added Notes 6 and 7. In schematics on sheet 1, added references to Notes 6 and 7; added "(Single-Phase 3-Wire) to top of each schematic. On sheet 2 added "(3-Phase 4-Wire)" to top of each schematic.
- Added Note 6 re. 601 bars. Added elevation view. Revised the two Reinforcement Schedule titles.
- In fourth column of table (TC-12.30 Type Supports), column "W", revised last three rows to "42 or 48".
- On sheet 1 added a 30" x 60" row for V-REC-1-2 category. In SQ-1-2 category on sheet 1, corrected "C" dimension, for 6" and 9" signs. In H-REC-1-2 category on sheet 2, corrected "D" dimension for 6" and 6.5" height signs.
- Added Note 7 re. RPM’s on bridges. Text agrees with information in TEM Section 302-2.
- Revised Notes 3.a.)3.) and 3.b.)2.). Revised top 2 "Wrong-Way Arrow at..." schematics to show 11 RPM’s. In lower schematic removed all RPMs on entrance ramp and added label “Entrance ramp RPMs installed per TC-65.11”. Also, added label “2-Way (Yellow/Red) @ 40’ (see Note 3)” for RPMs in exit ramp.
- In Note 5, revised last sentence by changing “All other devices shall be mounted...” to “Larger devices should be mounted....”.
- In four places, modified signal head graphic by moving man to left half, overlapping hand, and adding digits to the right half.
<table>
<thead>
<tr>
<th>MT-95.30</th>
<th>Closing Right or Left Lane of a Multi-Divided Highway with Drums</th>
<th>Change</th>
<th>• On pages 1 and 2, deleted “Flashing” before “Arrow Board(s)”; also, on page 3, Note 10, including section title. On page 3, previous Note 8C has been incorporated into Note 8B.</th>
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<tbody>
<tr>
<td>MT-95.31</td>
<td>Closing Right Lanes of a Multi-Lane Undivided Highway with Drums</td>
<td>Change</td>
<td>• On page 3, previous Note 8C has been incorporated into Note 8B.</td>
</tr>
<tr>
<td>MT-95.32</td>
<td>Closing Left Lanes of a Multi-Lane Undivided Highway with Drums</td>
<td>Change</td>
<td>• On page 3, previous Note 8C has been incorporated into Note 8B.</td>
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<td>MT-95.41</td>
<td>Closing Right Lanes of a Multi-Lane Undivided Highway with Portable Barrier</td>
<td>Change</td>
<td>• On page 3, previous Note 8C has been incorporated into Note 8B.</td>
</tr>
<tr>
<td>MT-95.45</td>
<td>Closing Shoulder of a Multi-Lane Divided Highway (NEW TITLE)</td>
<td>Change</td>
<td>• Removed “With Portable Barrier” from drawing title. On page 2, added new Notes 13B, 13C and 13E. Also, previous Note 8B has been incorporated into Note 8A.</td>
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<tr>
<td>MT-95.50</td>
<td>Supplemental Advanced Signs Used with Lane Closures</td>
<td>Change</td>
<td>• On page 1, deleted “Flashing” before “Arrow Board”.</td>
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<tr>
<td>MT-95.70</td>
<td>Median Crossover – Single Lane</td>
<td>Change</td>
<td>• On page 2, top of page, changed “1’ min.” to “2’ min.” Added a 2’ lateral clearance dimension for the opposing traffic on backside of PB.</td>
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<td>MT-95.71</td>
<td>Median Closure – Multi-Lane</td>
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<td>MT-95.72</td>
<td>Median Crossover of Passing Lane, Short Distance</td>
<td>Change</td>
<td>• On page 2, top of page, changed “1’ min.” to “2’ min.” On bottom of page, removed dotted lines that ran along upper set of drums. Added a 2’ lateral clearance dimension for the opposing traffic on backside of PB.</td>
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<td>MT-95.73</td>
<td>Median Crossover of Express Lane, Long Distance</td>
<td>Change</td>
<td>• On page 3, top of page, changed “1’ min.” to “2’ min.” Added a 2’ lateral clearance dimension for the opposing traffic on backside of PB. On bottom of page, removed dotted lines that ran along upper set of drums.</td>
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<tr>
<td>MT-98.30</td>
<td>Intersection Entrance Ramp and Turn Bay Closures</td>
<td>Change</td>
<td>• On page 3, previous Note 7C has been incorporated into Note 7B.</td>
</tr>
<tr>
<td>MT-99.20</td>
<td>Traffic Control for Long Line Pavement Marking Operations</td>
<td>Change</td>
<td>• On page 1, Note 6, removed references to “flashing”. On page 2, removed “flashing” from Notes 9c and 11b,1. In Note 12B, b2, replaced “panel” with “board”.</td>
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<tr>
<td>MT-99.30</td>
<td>Work Zone Delineation</td>
<td>Change</td>
<td>• In Notes 6a, 6b added “permanent” before concrete surfaces”. In Notes, 6c,</td>
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| MT-101.90 | Drop-Offs in Work Zones | **Change** | 6d and 6e, added “and temporary concrete surfaces” after “asphalt surfaces”.

- Added sentence to Note 13 re. 2’ offset. Added reference to Note 13 in Condition II schematics. |
## OFFICE OF ROADWAY ENGINEERING – TRAFFIC STANDARD CONSTRUCTION DRAWINGS (SCD’s)

### HIGHWAY LIGHTING

<table>
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<tr>
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<td>HL-10.11</td>
<td>Light Pole Styles</td>
<td>07/21/17</td>
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<td>Overhead Sign Supports (cont.)</td>
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<td>HL-10.12</td>
<td>Light Pole Details</td>
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<td>TC-15.115</td>
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<td>Pole Base Details</td>
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<td>TC-16.21</td>
<td>Single Arm Overhead Sign Support</td>
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<td>Extension of Median Barrier Anchor Bolts</td>
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<td>TC-17.10</td>
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<td>Light Tower Details</td>
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<td>TC-18.24</td>
<td>Flush Structure Mounted Sign Support</td>
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<td>TC-18.26</td>
<td>Skewed Structure Mounted Sign Support</td>
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<td>Foundations</td>
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<td>Pull Box Details</td>
<td>07/21/17</td>
<td>TC-21.50</td>
<td>Concrete Barrier Median Overhead Sign Support Foundations (Single Slope)</td>
<td>07/15/16</td>
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<td>TC-22.10</td>
<td>Miscellaneous Overhead Sign Support Details</td>
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<td>01/17/14</td>
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<td>Sign Attachment Assemblies</td>
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<td>TC-41.40</td>
<td>Special Sign Attachments and Supports</td>
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### TRAFFIC CONTROL

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<td>Typical Guide Sign Placement</td>
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<td>Semi-Overhead Sign Support</td>
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<td>Pole Mountings for Signal Heads</td>
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<td>Signal Tether Attachment</td>
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<td>Typical Flat Sheet Sign Placement</td>
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<td>TC-86.10</td>
<td>Railroad Preemption Interface Panel</td>
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### Miscellaneous

- Sign Support Foundations
- Foundations
- Sign Attachment Assemblies
- Sign Post Reflectors
- Typical Guide Sign Placement
- Typical Flat Sheet Sign Placement
- Aluminum Bolted Extrusheet Panel Sign
- Delineator Details
- Guardrail Blockout Reflector Details
- Rumble Stripes
- Raised Pavement Marker Placement Details
- Raised Pavement Marker Spacing Details
- Freeway and Expressway Entrance and Exit Pavement Markings
- Enhanced Wrong-Way Traffic Control for Ramps
- Structural Beam Sign Supports
- Structural Pipe Sign Support
- Laminated Veneer Wooden Box Beam Sign Support
- Sign Post Reflectors
- Special Sign Attachments and Supports
- One Way Sign Support Details
- Signal Tether Attachment
- Overhead Signal Attachments, Span Wire
- Railroad Preemption Interface Panel
- Structural Lighting: Lighting Pole Pilasters (New Title)
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<td>MT-95.30</td>
<td><strong>Closing Right or Left Lane of a Multi-Lane Divided</strong>&lt;br&gt;<strong>Highway with Drums</strong></td>
<td>07/21/17</td>
<td>MT-98.20</td>
<td>Lane Closure at Exit Ramp Using Drums</td>
<td>07/18/14</td>
<td>ITS-10.10</td>
<td>CCTV Assembly Details, Ground-Mounted Cabinet</td>
<td>07/17/15</td>
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<td>MT-98.21</td>
<td>Lane Closure at Exit Ramp Using Portable Barrier</td>
<td>07/18/14</td>
<td>ITS-10.11</td>
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<td>Lane Closure in Deceleration Lane</td>
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<td>MT-98.28</td>
<td>Lane Closure Within Exit Ramp</td>
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<td>01/20/17</td>
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<td>Intersection Entrance Ramp and Turn Bay Closures</td>
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<td>ITS-13.10</td>
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<td><strong>Supplemental Advanced Signs Used with Lane Closures</strong></td>
<td>07/21/17</td>
<td>MT-99.20</td>
<td>Traffic Control for Long Line Pavement Marking Operations</td>
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<td>ITS-14.10</td>
<td>Pull Box and Conduit Details</td>
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<td>Closure of Two-Way Left Turn Lane</td>
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<td>Work Zone Delineation</td>
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<td>Closure of Thru Lane of Three Lane Section with Two-Way Left Turn Lane</td>
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<td>MT-99.50</td>
<td>Freeway / Expressway Closure in Work Zones</td>
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<td>Power Service, Ground-Mounted Details</td>
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<td>Short-Term Closure of Multi-Lane Divided Highway</td>
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<td><strong>Median Crossover of Passing Lane, Short...</strong></td>
<td>07/21/17</td>
<td>MT-101.60</td>
<td>Road Closure Using Type 3 Barricades</td>
<td>01/20/17</td>
<td>ITS-30.11</td>
<td>Dynamic Message Sign - Pedestal Catwalk</td>
<td>01/15/16</td>
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<td>MT-95.73</td>
<td><strong>Median Crossover of Express Lane, Long...</strong></td>
<td>07/21/17</td>
<td>MT-101.70</td>
<td>Barrier and Impact Attenuator Delineation</td>
<td>01/17/14</td>
<td>ITS-30.12</td>
<td>Dynamic Message Sign – Pedestal Foundation (ROW)</td>
<td>01/15/16</td>
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<td>MT-95.82</td>
<td>Adjustments for Two-Lane, Two-Way Operation on Four-Lane Divided Roadways</td>
<td>07/19/13</td>
<td>MT-101.75</td>
<td>Impact Attenuator Placement</td>
<td>07/15/16</td>
<td>ITS-30.13</td>
<td>Dynamic Message Sign – Pedestal Support</td>
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<td>MT-96.11</td>
<td>Signalized Closing 1 Lane of a 2-Lane Highway</td>
<td>01/20/17</td>
<td>MT-101.80</td>
<td>PCB to Permanent Barrier Transitions</td>
<td>01/16/15</td>
<td>ITS-30.14</td>
<td>Dynamic Message Sign Pedestal – Pull Box and Conduit Details</td>
<td>01/15/16</td>
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<td>MT-96.20</td>
<td>Details for Signalized Closing 1 Lane of a 2-Lane Highway</td>
<td>07/15/16</td>
<td><strong>MT-101.90</strong></td>
<td>Drop-Offs in Work Zones</td>
<td>07/21/17</td>
<td>ITS-35.11</td>
<td>Dynamic Message Sign - Truss Catwalk</td>
<td>01/15/16</td>
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<tr>
<td>MT-96.26</td>
<td>Typical Wiring Diagram for One Signal Head and One Detector</td>
<td>07/19/13</td>
<td>MT-102.10</td>
<td>Lane Shift on a Multi-Lane Highway Using Portable Barrier</td>
<td>01/20/17</td>
<td>ITS-35.12</td>
<td>Dynamic Message Sign - Truss Foundation (ROW)</td>
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<td>MT-97.10</td>
<td><strong>Flagger Closing 1 Lane of a 2-Lane Highway - Stationary Operation</strong></td>
<td>07/18/14</td>
<td>MT-102.20</td>
<td>Lane Shift on a Multi-Lane Highway Using Drums</td>
<td>07/18/14</td>
<td>ITS-35.13</td>
<td>Dynamic Message Sign - Truss Support (Max. 80’)</td>
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<td>MT-97.11</td>
<td><strong>Flagger Closing 1 Lane of a 2-Lane Highway for Paving Operations (Non-Fed Only)</strong></td>
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<td>MT-102.30</td>
<td>Lane Shift Signing Incorporating Speed Limit and Penalties Signing</td>
<td>10/16/15</td>
<td>ITS-35.14</td>
<td>Dynamic Message Sign – Truss Support (81’ to 150’)</td>
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<td><strong>Flagger Closing 1 Lane of a 2-Lane Highway for Paving Operations (Fed)</strong></td>
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<td>MT-103.10</td>
<td>Construction Access Points</td>
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<td>Dynamic Message Sign – Truss &amp; Pedestal Foundations (Concrete Barrier)</td>
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<td>MT-97.20</td>
<td>Temporary Portable Rumble Strips for Use with 1-Lane 2-Way Operation Using Flaggers</td>
<td>07/15/16</td>
<td>MT-104.10</td>
<td>Work Zone Speed Zones (WZSZs) on High-Speed (≥ 55 MPH) Multi-Lane Highways</td>
<td>10/16/15</td>
<td>ITS-40.10</td>
<td>Destination Dynamic Message Sign</td>
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<td>MT-98.10</td>
<td>Lane Closure at Entrance Ramp</td>
<td>01/20/17</td>
<td>MT-105.10</td>
<td>Temporary Sign Support</td>
<td>07/19/13</td>
<td>ITS-50.10</td>
<td>Site Grounding</td>
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<td>MT-98.11</td>
<td>Lane Closure at Entrance Ramp Acceleration Lane</td>
<td>01/20/17</td>
<td>MT-110.10</td>
<td>Pedestrian Detour Methods</td>
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<td>ITS-50.11</td>
<td>Step-Down Transformer &amp; Support Details</td>
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<td><strong>Lane Closure at Entrance Ramp</strong></td>
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<td>MT-120.00</td>
<td>New Signal Activation</td>
<td>01/20/17</td>
<td>ITS-50.12</td>
<td>Work Pad - Sloped Area</td>
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<td>Remote Traffic Microwave Sensor Details</td>
<td>07/15/16</td>
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</table>
LIGHTNING PROTECTION SYSTEM

PORTABLE POWER UNIT DETAILS
(ELEVATION VIEW)

POLE DETAILS

NOTES:

1. Motor support tube may be 1 1/2" square or 1 3/8" square 10 feet on the inside or outside of drive support tube.

2. The drive assembly shall have sufficient output torque to handle the payload. Minimum driving torque shall be 40 ft-lbs. The drive system shall include a torque limiter of a size and rating as recommended by the manufacturer to prevent overdriving.

3. Electrical connector on flexible power cords, support ring and portable power unit shall conform to NEMA standard pin configurations for locking type connectors and be rated for 20 amperes for 480 volt circuits and 30 amperes for 250 volt circuits.

4. When grading or maintenance platform is required, pole handle shall be on the downslope side of pole. All other handholes shall be located on the side of the pole opposite the roadway from which the tower is stationed.

5. Unless otherwise specified in the plans, all luminaries with asymmetric distributions shall be installed so the "arrow" or "street side" designation on the optical assembly is positioned perpendicular to the centerline or baseline of the pavement from which the tower is stationed. Any optical rotation called for will be expressed as a clockwise or counter-clockwise angular measurement from the normal "arrow" orientation.

6. Terminal block and circuit breaker are shown in separate NEMA SX enclosures. If housed in a single enclosure, it shall meet NEMA SX requirements. All cable penetrations of enclosures shall be sealed with UL-listed cord grips to prevent rodent intrusion.

7. Attach varmint screen with stainless steel wire mesh and minimum 2" overlap. Use overlapping screen with stainless steel wire ties. Screen shall be welded wire mesh or expanded metal sheet, stainless steel or galvanized, with openings no larger than 3/16", or approved equal.
NOTES:

1. Foundations are designed for structures with round tapered shafts designed in accordance with the 2001 AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals", for a 90 mph wind zone when supporting the following:

   Six cylindrical luminaires with projected area of 3.6 square feet (154.6) and weighing 65 pounds each.

   One cylindrical head with projected area of 5.3 square feet (154.6) and 340 pounds top-latched lowering device.

2. Tower hand holes shall be on downslope of tower.

3. Foundation depth based on soil analysis. Foundation diameter based on Table 1. See chart in plans for required depths. If solid rock is encountered before reaching required depth, the remaining foundation depth may be decreased by 50 percent.

4. Light tower manufacturer responsible for anchorage design, which shall incorporate a minimum of eight anchor bolts per AASHTO (2002), 5.17. Manufacturer shall design anchor bolts using ACI 318 Appendix D and shall design any additional foundation reinforcing necessary.

Material strengths are:

- Fy = 60,000 psi
- fy = 4,000 psi

Anchor bolts shall be fastened inside the drilled shaft reinforcing cage. Anchor bolts shall be ASTM 354.

Anchor bolt size and spacing to fit mounting plate supplied with tower. However, bolt circle shall be equal to or less than the maximum bolt circle permitted in Table No. 1. The bolts shall be headed or have a hex nut on the embedded end. Threads shall be UNC-2B, and may be either rolled or cut, and coarse threaded. The embedded end of the anchor bolt shall be headed or threaded with a hex nut.

Anchor bolt material may be smooth steel rod that is threaded at the ends or threaded over its entire length, as per C&MS 711.02, American Standard heavy hex, Grade 50, with UNC-2B threads. Plate washers shall be A325 Grade 50 or Grade 60. Anchor bolts shall be fastened galvanized over their entire length, as per C&MS 711.02. All nuts and plate washers shall be permitted in Table No. 1. The bolts shall be headed and be placed in accordance with C&MS 711.02.

5. The length * of the 1/2" diameter spiral bar is in the foundation depth with a 3" clearance at each end. Four steel channels, ten or more square weighing approximately 9.80 pounds per foot of span shall be provided for each spiral unit. They shall be equally spaced along the periphery of the coil. Spiral lap splice length shall be 3"/ft. Provide one and a half turns at spiral ends.

6. Conduits in the foundation shall conform to C&MS 625 and 725. The foundation conduits shall be of the same material as that used to protect the circuit and be placed in accordance with C&MS 725.

7. All reinforcing shall be epoxy coated, comply with and be placed in accordance with C&MS 825.

8. All reinforcing shall be epoxy coated, comply with and be placed in accordance with C&MS 825.

**TABLE 1**

<table>
<thead>
<tr>
<th>FOUNDATION TYPE</th>
<th>D (IN)</th>
<th>B (IN)</th>
<th>BC MAX</th>
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<td>II</td>
<td>42</td>
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**TABLE 2**

<table>
<thead>
<tr>
<th>ANCHOR BOLT DIAMETER (IN)</th>
<th>PLATE WASHER DIAMETER (IN)</th>
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<tr>
<td>3/8</td>
<td>6</td>
<td></td>
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</tbody>
</table>
NOTES:

1. This foundation is intended for use with concrete barrier as detailed in Standard Construction Drawing (SCD) HL-20.13.

2. Conduits in the foundation shall conform to SCD 625 and 725. The foundation conduit shall be of the same material as that used to protect the circuit extension beyond the foundation.

3. See SCD HL-20.21 for additional details, reinforcing steel, and anchor bolts. The maximum anchor bolt embedment length shall be 49 inches.

4. See SCD HL-20.21 for grounding details.
NOTES:

1. Pull boxes shall conform with C&MS 625.11 and 725.07 or 725.06 or 725.08.
2. Conduit openings shall be sealed after conduit installation.
3. Aggregates used for pull boxes shall be No. 1 or 2, at least 6" deep. Cost for aggregate shall be included with the unit price bid for each pull box.
4. Pull box drains in accordance with C&MS 57 shall be installed as directed by the Engineer.
5. A durable label reminding the need to lubricate the threads of the cover hold down screws with grease or anti-seize compound shall be on the inside of the frame or upper wall.
6. See specifications for cover marking requirements.
7. Portland cement concrete pull box covers shall be cast iron with reinforcing ribs and matching frames by Neenah, Josam or Zurn foundries, or approved equal, or covers may be F/2 minimum galvanized plate steel.
8. Tapered thickness portland cement concrete pull box wells may be used; however, minimum wall thickness shall be as indicated.
9. Lifting rings or wire pulling rings may be incorporated into precast portland cement concrete pull box wells.
10. Conduit entries for cast-in-place portland cement concrete pull boxes shall be cast as required. Precast portland cement concrete pull boxes may have field core drilled or speed openings, or may have precast openings or knockouts. Knockouts shall be arranged to avoid compromising the structural integrity of the box.
11. Grounding bushings shown or connection to grounding conductor shall be bonded to the circuit grounding conductor by an approved UL-listed means. Braid length shall allow for complete removal of cover and placement on ground adjacent to the pull box, 48" minimum. Also, ground pull box lug connection using the braid or #4 AWG green wire.
12. Polymer concrete, fiberglass and plastic pull boxes (725.06, 725.07, and 725.12) shall come in the following nominal sizes based on volume. Linear dimensions shall match to +/- 5% and volume by +/- 10%.

<table>
<thead>
<tr>
<th>SIZE (in.)</th>
<th>LENGTH (in.)</th>
<th>WIDTH (in.)</th>
<th>DEPTH (in.)</th>
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</tbody>
</table>

PORTLAND CEMENT CONCRETE PULL BOX (725.08)

INSTALLATION WITH INDEPENDENT DRAIN

INSTALLATION WITH CONNECTION TO ROADWAY UNDERDRAIN

See Note 3

See Note 11

See Note 10

See Notes 2 and 10

See Note 3

See Note 9

Design: G. L. McIlvain

1st Drawing Release 0-2-2011

0-2-2011
NOTES:

1. There shall be a minimum of six electrodes, except on single span structures, in which there shall be a minimum of four electrodes.

2. Wet locations shall be used rather than dry locations.

3. No part of the structure shall be more than two spans from an electrode.

4. Provide two electrodes at each abutment.

5. Provide an earth ground within each outside column of pier.

6. Provide grounding plates for each grounding conductor.

7. Do not use surface-mounted ground lug conductors for new construction.

8. Alternate method at abutments:

   Route grounding conductors through one or more 1½ metal conduits to an electrode located in a pull box. Assure all metal conduits enclosing grounding conductors are bonded to an electrode located in a pull box. Conduit and pullbox are incidental. Alternate method by permission of the Engineer only, or by Plan Note.

9. Use UL-listed devices for all structure grounding connections, when listed devices are commercially available.

Bond Metal Parapet, Railings and/or Vandal Fence to Structure Grounding System at Each End, Minimum (See Note 3)

Bonding Required Between Units of Multi-Unit Structures When Units are Separated by Expansion Joints

Bond Signal Supports, Sign Supports and Light Poles to Structure Grounding System
NOTES:

1. All connections and bare copper strands of the 1/0 AWG cable exposed to concrete shall be covered with mastic to prevent contact with the concrete.

2. Installation of plane-type electrodes in dry areas and under pavements requires the use of Soil Ground Enhancement Material, incidental to the Structure Grounding item.

3. Use UL-listed devices for all structure grounding connections, when listed devices are commercially available.

---

**DRIVEN PILE FOOTER**

- Pile or Concrete
- Pile with Metal Casing

**DRILLED SHAFT**

- 1/0 AWG Stranded Insulated Copper Cable Exothermic Weld Connections
- Left in Place on Below Grade Portion of Drilled Shaft

**SPREAD FOOTER**

- 1/0 AWG Stranded Insulated Copper Cable Exothermic Weld to Caisson
- Plane Bedded in Sand Beneath Footer

**GROUND GRID**

- 3/8" Galvanized Steel Rods in Grid Exothermic Weld all Intersections
- Min. Depth 30"
This drawing replaces HL-50.21 dated 07-15-2016.

NOTES:

1. All electrical equipment to be bonded together. All electrical equipment available.

2. Use UL-listed devices for all structure grounding connections, when listed devices are commercially available.

3. AWG cable exposed to concrete shall be covered with mastic to prevent contact with the concrete.

4. Exothermic Weld to Ground Plate or to Junction Box and to Ground Plate.

---

Face of the Web of Each Facia Beam
Exothermically Welded to Inside 2" x 1/2" Thread Stud with Nut, Plate is Used Required When Splice Bonding Jumper Not

Insulated Copper Cable 1/0 AWG Stranded

STEEL BEAM CONTINUITY

BEAM CONNECTION

STEEL BEAM

PRECAST BOX BEAM AND PRECAST DECK PANEL

Exothermic Weld to Box and Beam

Exothermic Weld to Ground Plate

Exothermic Weld to Junction Box and to Ground Plate

Grounding Plate

Ground Plate

Ground Plate

Ground Plate

Ground Plate
Always ground this anchor bolt on the upstream side of the traffic. Identify the grounded roadway side, downstream, in the direction of traffic.

**Grounding Details (Typ.)**

1. All connections and bare copper strands of the 1/0 AWG cable exposed to concrete shall be covered with mastic to prevent contact with the concrete.
2. UL467 listed devices required for all structure grounding connections, when listed devices are commercially available.
3. Use UL-listed devices for all structure grounding connections.

**Notations:**

- EMBEDDED JUNCTION BOXES
- EXPOSED JUNCTION BOXES
- LIGHT POLE PARAPET PLAN
- CONDUIT GROUNDING
- ANCHOR BOLT GROUNDING

**Notes:**

- Grounding Stud Threaded into Box Wall
- Metal Conduit
- Plastic Conduit
- Grounding Bushing
- Slip Fit Conduits
- Watertight Hub
- Watertight Hub
- Copper Bonding
- Welded to Metal Plate
- Exothermically
- 2" x " Thread Stud
- 4" x 4" x " Metal Plate
- 5 " x " Shear Stud
- "L" Bolts
- Insulated Copper Cable
- 1/0 AWG Stranded

**Components:**

- Grounding Plate
- Jumper Terminations
- Clamp Jumper
- Plastic Conduit
- Metal Conduit
- Plain Bushing
- Copper Bonding
- Watertight Hub
- Insulated Copper Cable
- 1/0 AWG Stranded

**Office of Transportation Administration State of Ohio Department of:**

- David L. Holstein

**This drawing replaces HL-50.21 dated 07-15-2016.**
POLE BASE CONNECTIONS, LUMINAIRES WIRED LINE-TO-LINE (240, 480 VOLTS L-L, TYP.)

NOTES:
1. Provide sufficient slack in all cables to permit bringing connections outside of pole base through handhole of anchor base pole or door in transformer base pole.

2. Install ring tongue terminals on grounding conductors and connect to handhole frame on anchor base pole or basewall on transformer base pole with 3/4" diameter galvanized cap screw.

3. Fuses for connections shall be as follows:
   - Any standard midget ferrule type fuse (except glass tube) may be used in this connection.
   - Class T fuses rated 600 volts and 10 amperes shall be used unless otherwise specified.
120 and 120/240 VOLT CONNECTIONS

480 and 240/480 VOLT CONNECTIONS (SINGLE-PHASE)

NOTES:
1. Fuses shall be Class K.
2. Fuse shall be Class CC.
5. Enclosure construction shall conform to NEC Art 409.
6. Lighting branch circuits shown are schematic. Typically all branch circuits emanating from a control center have the same configuration. Voltages on all branch circuits emanating from a control center shall not exceed 31V.
7. Do not include neutral conductor in lighting branch circuits if all loads are connected line-to-line. See HL-60.11, HL-60.12 and HL-60.21.
NOTES:
1. Tie anchor bolts to rebar cage near the top and bottom of the anchor bolts. All rebar shall be epoxy coated.
2. nuts may be deeper as required in the plans.
3. When required by local conditions and approved by the Engineer, alternate foundation designs are acceptable.
4. Anchor bolts shall be ASTM F1554, Grade 105. Threads shall be UNC-2A, and may be either rolled or cut, or coarse threaded. The embedded end of the anchor bolt shall be headed or threaded with a heavy hex nut.
5. Set the top of the foundation 2" above the existing surface on the high side of the slope. The additional depth of foundation necessary to meet these requirements shall be added to the inclined plan.
6. At locations where the existing slope is 60 or greater, the buried depth of Foundation shall apply to the low side of the slope. Set the top of the Foundation 2" above the existing surface on the high side of the slope. The additional depth of foundation necessary to meet these requirements shall be added to the Grade 36. The 601 bars are used to tie the anchor bolts to the 603 bars.
Anchor Bolts

See vertical rebar diagram for size and number.

Vertical rebar, see vertical rebar diagram for size and number.

1. A special foundation design will be required when cohesive soil with undrained shear strength of less than 2000 lb/ft² or granular soil with an angle of internal friction less than 30° and a wet density less than 121 lb/ft³ is encountered.

2. Provide all anchor bolts with standard steel hex nuts, leveling nuts, and plumb washers. The nuts shall be capable of developing the full strength of the anchor bolts. Anchor bolts shall be Grade 105. Threads shall be UNC-2A, and may be either rolled or cut, and coarse threaded. The embedded end of the anchor bolt shall be headed or threaded with a heavy hex nut. Anchor bolt material may be smooth steel rod that is threaded at the ends or threaded over its entire length. Hex nuts shall be ASTM A563, American Standard Heavy hex, Grade FH, with UNC-2B threads. Plumb washers shall be ANSI Grade 40 or Grade 50. Anchor bolts shall be hot-dip galvanized over their entire length, per C&MS 110.20, after fabrication and threading. All nuts and plumb washers shall be galvanized per C&MS 711.04.

3. Provide a minimum of one capped 2" conduit ell in Standard Construction Drawings Table 10.20 and Table 11.21 for future use. This ell is in addition to any other conduits specified in the plans.

4. Tie spacing, starting from the top of the drilled shaft, shall be 3' between the first two ties and 3' spacing thereafter.

5. All reinforcing steel shall be spayed coated and comply with and be placed in accordance with C&MS 509. Rebar cage shall extend to within 3' of top and bottom of foundation.

6. Use 3/4" preformed joint filler as per C&MS 705.03 between foundations and adjacent paved areas.

7. At locations where the existing slope is 1' or greater, the buried depth of foundation shall apply to the low side of the slope. Set the top of the foundation 2" above the existing surface on the high side of the slope. The additional depth of foundation necessary to meet these requirements shall be added to the formed top.

8. In paved areas only, and only with permission of the Engineer, a construction joint may be placed or found to allow movement of the square, formed top to the finished pavement elevation. The location of this construction joint shall be at the top of the cylindrical portion of the drilled shaft. An IDT inspector must be present during construction of each permitted joint, to ensure adequate construction joint bonding with compliance with C&MS 55.

NOTES:
NOTE:
1. All bolt holes shall be 3/16" in diameter and may be drilled or punched to finished size.
2. Dimensions between bolt holes shall be to tolerance of ±3/16".
3. For back-to-back mounting of STOP (R1-1) and DO NOT ENTER (R5-1) sign, follow details shown on Standard Construction Drawing TC-41.50.

<table>
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<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
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</table>

Situation Details:

- **V-REC-1-2**
- **V-REC-2-4**
- **V-REC-2-6**
- **SQ-1-2**
- **SQ-1-3** (Maintenance Marker)

*OFFICE OF ENGINEERING*

*STATE OF OHIO DEPARTMENT OF TRANSPORTATION*

David L. Holstein

07-21-2017

NOTE:

1. All bolt holes shall be 3/16" in diameter and may be drilled or punched to finished size.
2. Dimensions between bolt holes shall be to tolerance of ±3/16".
3. For back-to-back mounting of STOP (R1-1) and DO NOT ENTER (R5-1) sign, follow details shown on Standard Construction Drawing TC-41.50.
**NOTES:**

- Dimensions shown are in millimeters unless otherwise indicated.
- Refer to the detailed dimensions on the drawing for specific measurements.
- All notes and specifications are to be followed strictly.
ENGINER ROADWAY OFFICE OF

RAISED PAVEMENT MARKER SPACING DETAILS

NOTES:

1. Raised pavement markers shall not be placed within the intersection area.

2. Raised pavement markers on lane lines on freeways shall be one-way white spaced at 80', all other raised pavement markers on lane lines on multi-lane roadways and ramps shall be two-way white/red spaced at 80'.

3. When a channelizing line is less than 80' in length, one raised pavement marker shall be placed at each end of the line, and one shall be placed in the center of the line.

4. Raised pavement markers shall not be placed on edge lines on a through approach. 

5. All approaches at a signalized intersection shall be treated as shown in the stop approach detail by adding edge line markers along the right edge line.
NOTES:

1. Raised pavement markers shall not be placed within the intersection area.
2. Raised pavement markers in lane lines on multi-lane roadways and ramps shall be two-way white/red spaced at 80'.
3. When a channelizing line is less than 80' in length, one raised pavement marker shall be placed at each end of the line, and one shall be placed in the center of the line.
4. Raised pavement markers shall not be placed on edge lines in a through approach.
5. All approaches of a signalized intersection shall be treated as shown in the Stop Approach detail by adding edge line markers along the right edge line.
6. The spacing for center line raised pavement markers shall be 80' except for the following:
   a.) Shall not be installed on one-lane bridges, center line pavement markings, including raised pavement markers, shall be omitted on tangent alignments.
   b.) Shall be installed at twice the normal spacing on bridges longer than 400' on tangent alignments.
   c.) Shall be installed at the normal spacing on bridges less than 400'.
7. Raised pavement markers:
   a.) Shall be installed at twice the normal spacing on bridges.
   b.) Shall be installed at the normal spacing on tangent alignments.
   c.) Shall be installed at the normal spacing on any length bridges on a curve.

LEGEND

- 1-Way Reflectors
- 2-Way Reflectors
- Direction of Travel
**NOTES:**

1. Wrong-way arrow markings are placed on the ramps as follows:
   a) On ramps where lane-use arrows are not used, place the first wrong-way arrow 10 to 30 feet in advance of stop line. Place the second wrong-way arrow according to engineering judgment.
   b) On ramps where lane-use arrows are used, place the wrong-way arrow in advance of the first lane-use arrow at a spacing equal to or greater than the spacing between the lane-use arrows.
   c) On multi-lane ramps, a wrong-way arrow should be placed in each lane, side by side.

2. Traffic control signs are placed as follows:
   a) Place the wrong-way sign (R5-1A, 42" x 30") 250' min. in advance of the stop line. The height of the 2nd wrong-way sign should be 3' above the nearest edge of the pavement.
   b) The red sign post reflectors shall be added to the STOP sign, DO NOT ENTER sign, and wrong-way sign assembly.
   c) The DO NOT ENTER sign (R5-1) may be angled up to 45° towards left turning traffic.
   d) RPMs on the channelizing line/lane line -
      a) RPMs on the edge line -
         1) Shall be two-way white/red on white edge line
         2) Shall be two-way yellow/red on yellow edge line
         3) Eleven (11) RPMs shall be spaced 40' apart in advance of the stop line; the rest shall be installed per SCD TC-65.11.
   e) RPMs on the channelizing line/lane line -
      1) Shall be two-way white/red, spaced 40' apart
      2) Eleven (11) RPMs shall be spaced 40' apart in advance of the stop line; the rest shall be installed per SCD TC-65.11.

3. Raised pavement markers (RPMs) are placed as follows:
   a) RPMs on the edge line -
      1) Shall be two-way white/red on white edge line
      2) Shall be two-way yellow/red on yellow edge line
      3) Eleven (11) RPMs shall be spaced 40' apart in advance of the stop line; the rest shall be installed per SCD TC-65.11.

**TC-73.20**

**ENHANCED WRONG-WAY TRAFFIC CONTROL FOR RAMPS**

**LEGEND**

- Wrong Way Arrow
- 2-Way RPM Reflectors

**MOUNTING DETAILS**

- Red Reflector Post Strip (2)
- Red Reflector Post Strip (2)
- Red Reflector Post Strip (2)
- Red Reflector Post Strip (2)

**ENTRANCE RAMP DIRECTIONAL SIGN ASSEMBLY (OPTIONAL)**

- North
- South
- Enter

**WRONG-WAY ARROW AT SINGLE-LANE RAMP**

- Single 4" dotted line extension

**WRONG-WAY ARROW AT MULTI-LANE RAMP**

- Single 4" dotted line extension

**WRONG-WAY ARROW AT PARTIAL CLOVERLEAF INTERCHANGE**

- Dotted Line Extension

**THIS DRAWING REPLACES TC-73.20 DATED 07-15-2016.**

- OFFICE OF TRANSPORTATION ADMINISTRATOR
- ENGINEERING
- David L. Holstein
- PSinha

**SCD NUMBER**

- STANDARD ROADWAY CONSTRUCTION DRAWING
- 1
CONCRETE FOUNDATION
0.82 C.Y. 1.54 C.Y.

PLATE PEDESTAL BASE

PEDESTAL FOUNDATION

PEDESTAL ANCHOR BOLT
ASTM A307 STEEL

TRANSFORMER TYPE PEDESTAL BASE

NOTES:
1. 1/2" preformed joint filler as per CMS 705.03 shall be used between foundations and adjacent paved areas.
2. For cabinets, 4" minimum, 2 required. For pedestals, as shown in the plans.
3. The size, number and location of anchor bolts shall be in accordance with the manufacturer's recommenda-
tions.
4. All pedestals shall be provided with a method of securely attaching a 4 AWG insulated copper ground-
conductor to the pedestal or anchor bolt. No cables or connections shall be external to the pedestal.
5. The pedestal shaft length as shown in the plans includes the pedestal base height for either base design. The
maximum Equivalent Physical Area (EPA) of pedestal-mounted signal devices shall be 1 square ft. (3-section head
with backplate) or a bottom mounting height of 6" or less. Larger devices shall be mounted on 10'-10" bases and
plates.
6. The pedestal base shall set on the foundation top without grouting, preformed fillers or leveling nuts
under the base. Steel shims may be used under the base for leveling the installation.
7. The foundation area of contact with the pedestal base shall be level. If adjacent paved areas slope, the
remedial of the Foundation top shall be beveled to meet the adjacent elevations.
8. A cast steel anchor base of equivalent strength may be used in lieu of the base plate.
9. A 4" thick work pad shall be provided unless in an otherwise paved area. When required, this Item shall be
paid for under Item 633 Controller Work Pad. In level areas the top of the pad shall be 1" above the
ground line. In steeply sloped areas the pads location shall be adjusted to provide access and drainage.
10. Ground mounted controller cabinets shall be sealed to the foundation with a flexible weatherproof clear,
silicone caulking compound.
11. Threaded shaft connections into transformer-type pedestal bases shall resist rotation through the use
of mechanical fasteners. A galvanized or stainless steel through-bolt shall be used with a minimum
diameter of 1/2" and utilizing nylock or deformed-thread nuts.
12. Alternate to through-bolt: provide a deep collar on top of transformer base with three set screws of
stainless steel that engage the shaft above the threads after the shaft is threaded into the base.

See Note 1
See Note 2
See Note 3
See Note 4
See Note 5
See Note 6
See Note 7
See Note 8
See Note 9
See Note 10
See Note 11
See Note 12

**CONCRETE**

0.96 S.Y.

7. The foundation area of contact with the pedestal base shall be level. If adjacent paved areas slope, the
remedial of the Foundation top shall be beveled to meet the adjacent elevations.

8. A cast steel anchor base of equivalent strength may be used in lieu of the base plate.

9. A 4" thick work pad shall be provided unless in an otherwise paved area. When required, this Item shall be
paid for under Item 633 Controller Work Pad. In level areas the top of the pad shall be 1" above the
ground line. In steeply sloped areas the pads location shall be adjusted to provide access and drainage.

10. Ground mounted controller cabinets shall be sealed to the foundation with a flexible weatherproof clear,
silicone caulking compound.

11. Threaded shaft connections into transformer-type pedestal bases shall resist rotation through the use
of mechanical fasteners. A galvanized or stainless steel through-bolt shall be used with a minimum
diameter of 1/2" and utilizing nylock or deformed-thread nuts.

12. Alternate to through-bolt: provide a deep collar on top of transformer base with three set screws of
stainless steel that engage the shaft above the threads after the shaft is threaded into the base.

**CONCRETE**

0.96 S.Y.
332/336 CABINET FOUNDATION

ELEVATION VIEW

PLAN VIEW

4" Conduit Bushing

Ground Line

4" min. Conduit, 2 Required

8" Sch. 40 PVC (for Grounding Conductors)

499, 511 Concrete

See Note 3

36"

32"

36"

30"

30"

24" P.B.

24" P.B.

Door Hinge

Work Pad

See Note 1

Work Pad

See Note 1

NOTE: Pullbox Shall be Placed on Opposite Side of Door Hinge

332/336 CONTROLLER WORK PAD

(See Note 9)

PLAN VIEW

See Note 1
NOTES:

1. Vehicular signal heads shall utilize mounting brackets similar to those shown for pedestrian signal heads.
2. Signal head conduit brackets and conduit fittings shall be galvanized and painted (except pole clamps or bands) to match the body of the signal head.
3. For embedded steel poles, external conduit shall be similar to that shown in wood pole detail. External grounding will not be required unless specifically noted on the plans.
4. The signal head bracket area shall be attached to steel poles by one of the following methods:
   a. 1½" blind half coupling welded into the pole prior to galvanizing.
   b. Bracket arm hub plates attached to the pole as per note 2.
   c. Pole clamp with threaded hub.
   Field installation of the wiring holes for signal heads and pushbuttons will be permitted provided that the holes are drilled or hole sawed. No fresh cutting or field welding will be permitted. Cut surfaces shall be filled smooth and covered with two coats of zinc rich paint. Grommets or wiring guides shall be installed in the holes.
5. The following minimum size fasteners shall be used:
   a. CONDUIT BRACKET ARM HUB PLATES: ½" dia. x 3" long lag screws, or 20d spikes.
   b. CONDUIT STRAPS (Two hole): ½" x 3" long lag screws, or ¾" x 3" long round head wood screws, or 20d spikes.
   c. PUSHBUTTON SIGN: with brackets - ½" x 3" long lag screws, or without brackets - ½" x 3" long lag screws with ⅜" x 1" O.D. flat washer between the sign and pole (two per sign).  
d. PUSHBUTTON: #14 x 3" long round head wood screws, or 20d spikes.
6. The signal head bracket arms shall be attached to wood poles:
   a. CONDUIT BRACKET ARM HUB PLATES: ½" dia. x 3" long lag screws (two per hub plate).
   b. CONDUIT STRAPS (Two hole): ½" x 3" long lag screws, or 20d spikes.
   c. PUSHBUTTON SIGN: with brackets - ½" x 3" long lag screws, without brackets - ⅝" x 3" long lag screws with ½" O.D. flat washer between the sign and pole (two per sign).
   d. PUSHBUTTON: #14 x 3" long round head wood screws, or ½" x 3" long lag screws (two per pushbutton).
7. The following minimum size fasteners shall be used for the attachment of the indicated hardware to steel poles:
   a. CONDUIT BRACKET ARM HUB PLATES: ½" dia. screw or ½" wide passivated stainless steel band (two per hub plate).
   b. CONDUIT: Two hole conduit straps with ½" dia. screws or ½" wide passivated stainless steel band.
   c. PUSHBUTTON SIGN: ½" dia. screws (two per sign).
   d. PUSHBUTTON: ½" dia. screws (two per pushbutton).
   The screws shall utilize a drilled and tapped hole or be the self-tapping type.
**NOTES:**

**DESIGN SPEED:**

1. The design speed used for taper rates should typically be the permanent legal speed, however, on construction projects for which the speed limit is reduced, the reduced speed may be used in determining the taper rate when the taper is not the first active construction area within the project.

**TAPERS**

2A. The minimum acceptable length for the merge taper shall be determined by multiplying the width of offset by the merge taper rate. The merge taper rate is provided in Table II.

2B. The minimum acceptable length for the shoulder taper shall be determined by multiplying the width of the shoulder by the shoulder taper rate. The shoulder taper rate is provided in Table II.

2C. The tangent section between the two merge tapers shall be two times the length of the two merge tapers.

**SIGN SPACING**

3A. The work zone sign spacing shown in Table I are minimums. Maximum spacing should not be greater than 1.5 times the distances shown in Table I.

3B. Sign spacing should be adjusted to avoid conflict with existing signs. Minimum spacing to existing signs shall be 800' for speeds of 40 mph or less and a minimum of 400' for speeds 40 mph or greater.

**ADJUSTMENTS FOR SIGHT DISTANCE**

4. The location of the merging taper and the advance warning signs should be adjusted to provide adequate sight distance for the existing vertical and horizontal roadway alignment.

**BASIC SIGNING**

5A. ROAD WORK AHEAD (W20-5) signs shall be provided on entrance ramps or roadways entering the work limits.

5B. END ROAD WORK (G20-2) signs are only required for lane closures. A minimum of 1200' to 2000' of advance warning shall be provided. A minimum of 1200' is required for speeds of 50 mph or greater. A minimum of 2000' is required for speeds of 45 mph or less and a minimum of 4000' for speeds 25 mph or less.

5C. Overlapping of signing for adjacent projects should be avoided whenever possible. The signs shall be coordinated with the Ohio Department of Transportation for work on the same project.

5D. The existing conflicting pavement markings shall be removed or covered per OMS 6M-10.

**SIGNING DETAILS**

6A. The advisory speed W3-4I plaque shall be used when specified in the plan.

6B. When the advance speed limit is 40 mph or less, 35' warning signs may be used.

6C. The distance plaque W3-56a or W3-56b if the distance shown is in feet shall indicate the distance to the beginning of the merging taper. Distances less than 1 mile may be expressed in feet. The plaque may be omitted if Extra Advance Sign Groups are not used.

6D. Provide signing on the inactive side of the highway, as shown, whenever specified in the plan.

6E. Provide the appropriate word or symbol legend necessary on lane reduction W4-4, W5-5, W3-5a signs to correctly identify which lane is to be closed.

**EXTRA ADVANCE WARNING SIGNING**

7A. Extra Advance Warning Sign Groups consisting of ROAD WORK AHEAD, LANE CLOSED AHEAD, LANES CLOSED AHEAD, and END ROAD WORK STOPPED TRAFFIC signs plus distance plagues may be specified in the plans. The placement of the signs may be required to be coordinated, as determined by the Engineer (See Standard Construction Drawing ISO MT-95.50).

**Pavement Markings (RPM)**

8A. If the construction operation requires a lane closure for more than 1 day, the existing conflicting reflectors shall be removed from the raised pavement markers RPM.

8B. Additionally, if a lane closure of greater than 3 days is required, the following shall be performed:

a) The appropriate color work zone edge lines shall be applied along the taper and tangent sections.

b) The existing conflicting pavement markings shall be removed or covered per OMS 6M-10.

8C. Work zone pavement markings which would conflict with final traffic lanes shall be removable type CMS 9M-06, type II, unless the area will be resurfaced prior to project completion.

8D. Work zone pavement markings which would conflict with final traffic lanes shall be removed in accordance with OMS 6M-10. The original markings and raised pavement markers shall be restored at no additional cost unless separately itemized in the plans.

**RESERVED FOR FUTURE USE**

9A. Intentionally Blank

**ARROW BOARD**

10. The arrow board shall be chosen from the SCD approved list and follow the guidelines in Supplemental Specification 821.

**FLASHING MARKINGS**

11. Type A flashing warning lights shown on the ROAD WORK AHEAD, LANE CLOSED AHEAD, on the LANES CLOSED AHEAD signs, and on the LANE CLOSED AHEAD signs are required whenever a night time lane closure is necessary.

**INTERSECTION / DRIVEWAY ACCESS**

12. Within the length of the closure, provision shall be made to control traffic entering from intersecting streets and major drives as necessary to prevent weaving movements and to keep vehicles off of new pavement not ready for traffic. The Contractor shall:

- Place around the closed lane, either drums, cones, or barricades, as needed.
- Provide at least one flagger of every public street intersection and major driveway.

**SHADOW VEHICLE**

13A. The shadow vehicle shall be in place and unoccupied whenever workers are in the work area. The shadow vehicle shall be removed from the pavement whenever workers are not in the work area.

13B. The shadow vehicle shall be equipped with an intensity yellow rotating, flashing, oscillating, or strobe lights.

**BUFFER SPACE**

14. Where space constraints do not allow for the buffer space of 1.5 feet, a 20' downstream taper (if applicable) will not be permitted. Either cones shall be used for the entire length of the taper section, or drums shall be used for the entire length.

**CONE USE**

15A. Where space constraints do not allow for the buffer space of 1.5 feet, a shorter length may be used.

**BUFFER SPACE**

16. Where space constraints do not allow for the buffer space, a shorter length may be used.

**REPLACEMENT OF MT-95.30**

This drawing replaces MT-95.30 dated 07-15-2016.

**SCD NUMBER**

This drawing replaces MT-95.30 dated 07-15-2016.

**STATE OF OHIO DEPARTMENT OF TRANSPORTATION**

**ENGINEER**

This drawing replaces MT-95.30 dated 07-15-2016.

**ENGINEERING**

This drawing replaces MT-95.30 dated 07-15-2016.

**OFFICE OF TRANSPORTATION ADMINISTRATOR**

This drawing replaces MT-95.30 dated 07-15-2016.

**MULTI-LANE DIVIDED HIGHWAY WITH DRUMS**

Drums located placed along the closed lane shall be located 25' beyond the projected pavement edges of the driveway or cross highway, as shown in SCD MT-94.12. For barricades, see SCD MT-61.60.

Existing STOP signs shall be relocated as necessary to assure proper location for the traffic conditions.

The method of control shall be subject to the approval of the Engineer.
If the required minimum width for the open lane cannot be provided, the adjacent opposing lane shall be closed.

**Table 1: Sign Spacing**

<table>
<thead>
<tr>
<th>ROAD TYPE</th>
<th>SPEED LIMIT (MPH)</th>
<th>Merging Taper Rate</th>
<th>Shoulder Taper Rate</th>
<th>Minimum Drum Spacing (FT)</th>
<th>Buffer Zone (FT)</th>
</tr>
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<tbody>
<tr>
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<td>1 in.</td>
<td>1.5 in.</td>
<td>25 ft.</td>
<td>55 ft.</td>
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<tr>
<td></td>
<td>30</td>
<td>1 in.</td>
<td>1.5 in.</td>
<td>30 ft.</td>
<td>200 ft.</td>
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<tr>
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<td>35</td>
<td>1 in.</td>
<td>1.5 in.</td>
<td>35 ft.</td>
<td>250 ft.</td>
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<td>305 ft.</td>
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<td>3 in.</td>
<td>3.5 in.</td>
<td>45 ft.</td>
<td>360 ft.</td>
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<td>425 ft.</td>
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<tr>
<td></td>
<td>55</td>
<td>5 in.</td>
<td>5.5 in.</td>
<td>55 ft.</td>
<td>495 ft.</td>
</tr>
</tbody>
</table>

**Legend**

- Work Area
- Drums/Cones
- Remove Existing Markings
- Direction of Travel
- Shadow Vehicle

**Plot Number**

MT-95.31

**Closing Right Lanes of a Multi-Lane Highway with Drums**

**Drawn by**

David L. Holstein

**Transportation Administrator**

State of Ohio Department of Transportation

07-21-2017

**Table II**

<table>
<thead>
<tr>
<th>ROAD TYPE</th>
<th>DISTANCE BETWEEN SIGNS (FT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major Conventional</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>500</td>
</tr>
<tr>
<td>Freeway &amp; Expressway</td>
<td>1000</td>
</tr>
</tbody>
</table>

**Note:**

This drawing replaces MT-95.31 dated 01-20-2017.

Dotted Line

Work Zone

If the required minimum width for the open lane cannot be provided, the adjacent opposing lane shall be closed.

Arrow Board

Merge Taper Length (See Note 2C)

Shoulder

If the required minimum width for the open lane cannot be provided, the adjacent opposing lane shall be closed.

Table 1 (Sign Spacing)

<table>
<thead>
<tr>
<th>ROAD TYPE</th>
<th>DISTANCE BETWEEN SIGNS (FT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major Conventional</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>500</td>
</tr>
<tr>
<td>Freeway &amp; Expressway</td>
<td>1000</td>
</tr>
</tbody>
</table>

**Note:**

This drawing replaces MT-95.31 dated 01-20-2017.

Dotted Line

Work Zone

Arrow Board

Merge Taper Length (See Note 2C)

Shoulder

If the required minimum width for the open lane cannot be provided, the adjacent opposing lane shall be closed.

Table 1 (Sign Spacing)

<table>
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<th>ROAD TYPE</th>
<th>DISTANCE BETWEEN SIGNS (FT)</th>
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<td>Major Conventional</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>500</td>
</tr>
<tr>
<td>Freeway &amp; Expressway</td>
<td>1000</td>
</tr>
</tbody>
</table>
NOTES:

1. The design speed used for taper rates should typically be the permanent legal speed, however, on construction projects in which the speed limit is reduced, the reduced speed may be used in determining the taper rate when the taper is not the first active construction area within the project.

2. The minimum acceptable length for the merge taper should be determined by multiplying the width of offset by the taper rate. The merge taper rate is provided in Table 2.

3. The minimum acceptable length for the shoulder taper should be determined by multiplying the width of the shoulder by the shoulder taper rate. The shoulder taper rate is provided in Table 2.

4. The tangent section between the two tapers should be two times the length of the two merge tapers.

SIGN SPACING

3A. The work zone sign spacing shown in Table 1 are minimums. Maximum spacing should not be greater than 15 times the distances shown in Table 1.

3B. Sign spacing should be adjusted to avoid conflict with existing signs. Minimum spacing to existing signs shall be 200' for speeds of 40 mph or less and a minimum of 400' for speeds 50 mph or greater.

ADJUSTMENTS FOR SIGHT DISTANCE

4. The location of the merging taper and the advance warning signs should be adjusted to provide for adequate sight distance for the existing vertical and horizontal roadway alignment.

SIGNING DETAILS

5A. ROAD WORK AHEAD (W20-1) signs shall be provided on entrance ramps or roadways entering the work limits.

5B. END ROAD WORK (G20-2) signs are only required for lane closures of more than 1 day. It is intended that these signs be placed on the mobiles, on all exit ramps, and on the shoulder by the shoulder taper rate. The shoulder taper rate is provided in Table 2.

5C. Overlapping of signing for adjacent projects should be avoided where the messages could be confusing. Any #40-5 or #40-50 signs which fall within the limits of another traffic control zone shall be shifted or covered during the period when both projects are active.

SIGNING DETAILS

6A. The advisory speed W20-3P plaque shall be used when specified in the plan.

6B. When the approach speed limit is 40 mph or less, 36" warning signs may be used.

6C. The distance plaque W16-3aP (or W16-2aP if the distance warning signs may be used.

6D. Provide signing on the inactive side of the highway, as shown, when specified in the plan.

EXTRA ADVANCE WARNING SIGNING

7. Extra advance warning sign groups consisting of ROAD WORK AHEAD (W20-1), LANE CLOSED AHEAD (W20-2), LANE CLOSED AHEAD (W20-4), and END FOR STOPPED TRAFFIC warning signs plus distance plaques may be specified in the plan or may be required to be directed, as determined by the Engineer (see Standard Construction Drawing (SCD) MT-95.30).

PAVEMENT MARKINGS / RPMs

8A. If the construction operation requires a lane closure for more than 1 day, the existing conflicting reflectors shall be removed from the raised pavement markers (RPMs).

8B. Additionally, if a lane closure of greater than 3 days is required, the following shall be performed:

   a) The appropriate color work area edge lines shall be applied along the taper and tangent sections.
   b) The existing conflicting pavement markings shall be removed or covered as per CMS 654.16.C.
   c) Work zone edge lines in length separated by 8' spaces, shall be provided to identify the merge.
   d) Work zone pavement markings which conflict with final traffic lines shall be removed or covered as per CMS 740.06.B.
   e) Type 3 unless the area will be resealed prior to project completion.
   f) After completion of the work, pavement markings other than CMS 654.16.C, Type 3 unless the area will be resealed prior to project completion.

RESERVED FOR FUTURE USE

9A. (Intentionally blank)

9B. Arrow board

10. The arrow board shall be chosen from the DOT approved list and follow the guidelines in Supplemental Specification 410.

FLASHING WARNING LIGHTS

11. Type A flashing warning lights shown on the ROAD WORK AHEADWarning signs on the LANE CLOSED AHEAD Warning signs are required whenever a night lane closure is necessary.

INTERSECTION / DRIVEWAY ACCESS

12. Within the length of the closure, provision shall be made to control traffic entering from intersecting streets and major driveways as necessary to prevent wrong-way movements and to keep vehicles off of new pavement not ready for traffic. The contractor shall:

   a) Place across the closed lane, either 3 drums or cones, and/or
   b) Provide an additional flagger at every public street intersection and major driveway.

Drums or cones placed across the closed lane shall be located 25' beyond the projected pavement edge of the driveway, as shown in SCD MT-95.31. For barricades, see SCD MT-95.60.

Existing STOP signs shall be relocated as necessary to assure proper location for the traffic conditions.

The method of control shall be subject to the approval of the Engineer.

SHADOW VEHICLE

13A. The minimum drum spacing along tapers and along tangent sections shall be as shown in Table 2. A minimum of 3 drums shall be used to close the upstream shoulder. The downstream taper drum spacing shall be approximately 20'.

13B. Cones may be substituted for drums as follows:

   a) Use of cones is permissible for either daytime operation or for nighttime operation, but shall not be used continuously, 24 hours a day, when it is determined by the Engineer that drums will be more effective.
   b) Cones used for daytime traffic control shall have a minimum height of 36".
   c) Cones used for nighttime traffic control shall have a minimum height of 42".
   d) Use of cones at night shall be prohibited along tangents.
   e) Cone spacing at night shall be a minimum of 40' for the entire length of the taper section, or drums shall be used for the entire length.

13C. Provisions shall be made to stabilize the cones and drums to prevent them from blowing over.

13D. All drums and cones should have a minimum offset from the edge of the traveled lanes of 15 feet.

SHADOW VEHICLE

14A. The shadow vehicle shall be in place and unoccupied whenever workers are in the work area. This vehicle shall be removed from the pavement whenever workers are not in the work area.

14B. The shadow vehicle shall be equipped with a high-intensity yellow rotating, flashing, oscillating, or strobe light(s).

14C. The shadow vehicle shall be equipped with a truck-mounted shadow vehicle when specified in the plan.

BUFFER SPACE

15A. Where space constraints do not allow for the buffer space, a shorter length may be used.
NOTES:

DESIGN SPEED
1. The design speed used for taper rates should typically be the permanent legal speed, however, on construction projects where the speed limit is reduced, the reduced speed may be used in determining the taper rate when the taper is not the first active construction area within the project.

TAPERS
2A. The minimum acceptable length for the merge taper shall be determined by multiplying the width of the offset by the design speed for speeds 50 mph or greater. The merge taper rate is provided in Table II.
2B. The minimum acceptable length for the shoulder taper shall be determined by multiplying the width of the shoulder by the shoulder taper rate. The shoulder taper rate is provided in Table II.
2C. The tangent section between the two merge tapers shall be two times the longer of the two merge tapers.

SIGN SPACING
3A. The work zone sign spacings shown in Table I are minimums. Maximum spacing should not be greater than 1.5 times the distances shown in Table I.
3B. Sign spacing should be adjusted to avoid conflict with existing signs. Minimum spacing to existing signs shall be 200' for speeds of 45 mph or less and a minimum of 400' for speeds 50 mph or greater.

ADJUSTMENTS FOR SIGHT DISTANCE
4. The location of the merging taper and the advance warning signs should be adjusted to provide for adequate sight distance for the existing vertical and horizontal roadway alignment.

BASIC SIGNING
5A. ROAD WORK AHEAD (W5x1-4) signs shall be provided on entrance ramps or roadways entering the work limits.
5B. END ROAD WORK (S20-3x) signs are only required for lane closures of more than 1 day. It is intended that these signs be placed on the roadside, on all exit ramps, and on all approaches to the intersection.
5C. Overlapping of signing for adjacent projects should be avoided where the messages could be confusing. Any W5x1 or W5x4 signs which conflict with any other traffic control zone shall be omitted or covered during the period when both projects are active.

SIGNING DETAILS
6A. The advisory speed W3-24 plaque shall be used when specified in the plan.
6B. When the approach speed limit is 40 mph or less, 35' warning signs may be used.
6C. The distance plaque W3-58 for W3-59 or W3-59 if the distance shown is in feet shall indicate the distance to the beginning of the merging taper. Distances less than 1 mile may be expressed in feet. The plaque may be omitted if Extra Advance Warning Signs are not used.
6D. Provide signing on the inactive side of the highway, as shown, when specified in the plan.

EXTRA ADVANCE WARNING SIGNING
7. Extra Advance Warning Sign Groups consisting of ROAD WORK AHEAD (W5x1-4), LANE CLOSED AHEAD (W5x4-3), LINES CLOSED AHEAD (W3-59), and WATCH FOR STOPPED TRAFFIC W3-40a sign plus Distance plaques may be specified in the plans or may be required to be erected, as determined by the Engineer (see Standard Construction Drawing SSD-95-301).

PAVEMENT MARKINGS / RPMs
8A. If the construction operation requires a lane closure for more than 1 day, the existing conflicts reflectors shall be removed from the raised pavement markers (RPMs).
8B. Additionally, if a lane closure of greater than 3 days is required, the following shall be performed:
   a) The appropriate color work zone edge lines shall be applied along the taper and tangent sections.
   b) The existing conflict pavement markings shall be removed or covered per CMS 614.10.
   c) Work zone edge lines, in length segregated by flag, shall be provided to identify the merge.
8C. Work zone pavement markings which conflict with final traffic lanes shall be removable tape (CMS 760.06). Type 3 in this area will be reapplied prior to project completion.
8D. After completion of the work, work zone markings other than CMS 760.06, Type 3 shall be removed in accordance with CMS 614.12. The original markings and raised pavement marker reflectors shall be restored at no additional cost unless separately itemized in the plans.

RESERVED FOR FUTURE USE
9A. (Unintentionally blank)

ARROW BOARD
10. The arrow board shall be chosen from the ODOT approved list and follow the guidelines in Supplement Specification 401.

FLASHING WARNING LIGHTS
11. Type A flashing warning lights shown on the ROAD WORK AHEAD (W5x1-4) signs and the LANE CLOSED AHEAD (W3-59) signs are required whenever a lane closure is necessary.

INTERSECTION / DRIVEWAY ACCESS
12. Within the length of the closure, provision shall be made to control traffic entering from intersecting streets and major drives to prevent wrong-way movements and to keep vehicles off of new pavement not ready for traffic. The contractor shall:
   a) Provide additional flagger(s) or additional signed flagger(s) at the intersection to control traffic.
   b) Maintain adequate space to the edge of the intersection or driveway.
   c) Control traffic to prevent them from blowing over.

SHADOW VEHICLE
13A. Drums placed across the closed lane shall be located 25' beyond the projected pavement edge of the driveway, as shown in SSD-95-31. For barriodles, see SSD-95-306.

13B. Additionally, if a lane closure of greater than 3 days is required, the following shall be performed:
   a) Use of drums is permissible for either daytime operation or for nighttime operation, but shall not be used continuously, day and night upon completion of work within the work period. The cones shall be removed. They may again be placed on the highway in order to resume work in the following such work period.
   b) Cones used for daytime traffic control shall have a minimum height of 36".
   c) Cones used for nighttime traffic control shall have a minimum height of 42".
   d) Use of cones at night shall be prohibited along tapers.
   e) Cones spacing at night shall be at a maximum of 40'.
   f) Where cones are substituted for drums along tapers, interrupting of channelizing devices within the same run will not be permitted. Either cones shall be used for the entire length of the taper, or drums shall be used for the entire length. Where cones are substituted for drums along tapers.

13C. Provisions shall be made to stabilize the cones and drums to prevent them from blowing over.
13D. Drums shall not encroach into the opposing lane of traffic. If drums encroach into the opposing lane, the lane shall be closed.
13E. All drums and cones should have a minimum offset from the edge of the traveled lanes of 1.5 feet.

SHADOW VEHICLE
14A. The shadow vehicle shall be in a protected lane and be stopped by the shadow vehicle only. The vehicle shall be removed from the pavement wherever workers are not in the work area.
14B. The shadow vehicle shall be equipped with a high-intensity yellow flashing, oscillating, or strobe lights.
14C. The shadow vehicle shall be equipped with a work zone edge by the Engineer.

S P A C I N G / C O N T R O L
15A. The minimum drum spacing along tapers and along tangent sections shall be as shown in Table II. A minimum of 3 drums shall be used to close the upstream shoulder. The downstream taper drum spacing shall be approximately 20'.
15B. Cones may be substituted for drums as follows:
   a) Use of cones is permissible for either daytime operation or for nighttime operation, but shall not be used continuously, day and night upon completion of work within the work period. The cones shall be removed. They may again be placed on the highway in order to resume work in the following such work period.
   b) Cones used for daytime traffic control shall have a minimum height of 36".
   c) Cones used for nighttime traffic control shall have a minimum height of 42".
   d) Use of cones at night shall be prohibited along tapers.
   e) Cones spacing at night shall be at a maximum of 40'.
   f) Where cones are substituted for drums along tapers, interrupting of channelizing devices within the same run will not be permitted. Either cones shall be used for the entire length of the taper, or drums shall be used for the entire length. Where cones are substituted for drums along tapers.

PAVEMENT MARKINGS / RPMs
16A. Additionally, if a lane closure of greater than 3 days is required, the following shall be performed:
   a) Use of cones is permissible for either daytime operation or for nighttime operation, but shall not be used continuously, day and night upon completion of work within the work period. The cones shall be removed. They may again be placed on the highway in order to resume work in the following such work period.
   b) Cones used for daytime traffic control shall have a minimum height of 36".
   c) Cones used for nighttime traffic control shall have a minimum height of 42".
   d) Use of cones at night shall be prohibited along tapers.
   e) Cones spacing at night shall be at a maximum of 40'.
   f) Where cones are substituted for drums along tapers, interrupting of channelizing devices within the same run will not be permitted. Either cones shall be used for the entire length of the taper, or drums shall be used for the entire length. Where cones are substituted for drums along tapers.

SHADOW VEHICLE
17A. The shadow vehicle shall be in a protected lane and be stopped by the shadow vehicle only. The vehicle shall be removed from the pavement wherever workers are not in the work area.
17B. The shadow vehicle shall be equipped with a high-intensity yellow flashing, oscillating, or strobe lights.
17C. The shadow vehicle shall be equipped with a work zone edge by the Engineer.
NOTES:  

DESIGN SPEED:  
1. The design speed used for taper rates should typically be the permanent legal speed; however, on construction projects for which the speed limit is reduced, the reduced speed may be used in determining the taper rate when the taper is the first active construction area within the project.

TAPERS  
2A. The minimum acceptable length for the merge taper shall be determined by multiplying the width of offset by the safe taper rate. The merge taper rate is provided in Table II.
2B. The minimum acceptable length for the shoulder taper shall be determined by multiplying the width of the shoulder by the shoulder taper rate. The shoulder taper rate is provided in Table II.
2C. The tangent section between the two tapers should be Two Times the longer of the Two merge Tapers.

SIGN SPACING  
3A. The work zone sign spacing shown in Table I are minimums. Maximum spacing should not be greater than 1.5 Times the distances shown in Table 1.
3B. Sign spacing should be adjusted to avoid conflict with existing signs. Minimum spacing to existing signs shall be 300' for speeds of 40 mph or less and a minimum of 400' for speeds 50 mph or greater.

ADJUSTMENTS FOR SIGN DISTANCE  
4. The location of the merging taper and the advance warning signs should be aligned to provide for adequate sight distance for the existing vertical and horizontal alignment.

BASIC SIGNING  
5A. ROAD WORK AHEAD (W20-5) signs shall be provided on entrance ramps or roadways entering the work limits.
5B. END ROAD WORK (W20-2) signs are only required for lane closures for more than 1 day. The existing conflicting traffic reflectors shall be removed from the raised pavement markers (RPMs).
5C. Additionally, if a lane closure of greater than 3 days is required, the following shall be performed:
   a) The appropriate color work zone edge lines shall be applied along the taper and tangent sections.
   b) The existing conflicting pavement markings shall be removed or covered per CM 644.16.
   c) Work zone dotted lines, 1' in length separated by 9' gaps, shall be provided to identify the merge.
5D. Work zone pavement markings which would conflict with final traffic lanes shall be removable tape (CMS 740.06), Type 3 unless the area will be restorated prior to project completion.
5E. After completion of the work, pavement markings other than CMS 740.06, Type 1 shall be removed in accordance with CMS 644.2.1. The original markings and raised pavement markers reflectors shall be restored at no additional cost unless separately itemized in the plans.

RESERVED FOR FUTURE USE  
9A. (Unintentionally blank)

ARROW BOARD  
10A. Arrow board shall be chosen from the DOT approved list and follow the guidelines in Supplement Specification 411.

FLASHING WARNING LIGHTS  
11A. Type A flashing warning lights shown on the ROAD WORK AHEAD (W20-5) and END ROAD WORK AHEAD (W20-5) signs are required whenever a night lane closure is necessary.

INTERSECTION / DRIVEWAY ACCESS  
12A. Within the length of the closure, provision shall be made to control traffic entering from intersecting streets and major drives so necessary to prevent errant movements and to keep vehicles off the new pavement not ready for traffic. The contractor shall:
   a) Place across the closed lane, either 3 drums or barricades, and/or
   b) Provide an additional barrier of every public street intersection and major driveway.

EXISTING STOP SIGNS shall be relocated as necessary to assure proper function for the traffic conditions.

PAVEMENT SPACING  
6A. The maximum drum spacing along tapers and along tangent sections shall be as shown in Table II. A minimum of 5 drums shall be used to close the upstream shoulder.
6B. All drums and cones should have a minimum offset from the edge of the traveled lanes of 15'6".

PORTABLE BARRIER (PB)  
14A. A tapered end section may be used in place of the impact attenuator of locations where the last full section of PB can be extended outside of the clear zone for approaching traffic. See Table II for clear zone widths.
14B. If it is necessary to provide the contractor with access to the work area behind the PB, the PB and treatment shall include an impact attenuator. The maximum width of the opening shall be 9' between the impact attenuator and the outside edge of the pavement shoulder.
14C. If Contractor access is provided per Note 14B, the length of PB shall be adequate to shield the PB area from the motorist. This length of need of PB shall be determined from the calculations provided in SCD MT-01.06 and The LID Manual, Volume 1, Figure 602-6, and shall require the approval of the Engineer.
14D. When used, impact attenuators shall be installed parallel to traffic. Also, the last full section of PB, adjacent to the impact attenuator, shall be located parallel to traffic.
14E. Where narrow medians are provided, see Table II to determine whether or not the downstream end of the PB is located within the clear zone of opposing traffic. If the PB is located within the clear zone of opposing traffic in the downstream end shall be flared away from approaching traffic to shield the work area from potential errant vehicles crossing the median.
14F. If the PB is located beyond the clear zone of opposing traffic, the downstream end of the PB may be provided with a tapered end, located 3' beyond the work area.
14G. Where PB is located beyond the edge of the paved shoulder, the cross slope within the closed shoulder, including the surface on which the PB is placed, shall be graded at 1:1:5, or flatter. If the cross slope is steeper than 1:5, the PB shall be extended along the paved shoulder as necessary to satisfy the length of need, and then terminated using an impact attenuator.
14H. The work area shall be adequately protected from traffic approaching from intersections and driveways approaching using PB and impact attenuators as called for by the Engineer.
14I. For installation procedures, refer to the manufacturer’s installation instructions.
14J. For details on delineation of PB, see Standard Construction Drawing MT-50.70.

BUFFER SPACE  
15A. Where space constraints do not allow for the buffer space, a shorter length may be used.
**TABLE I** (SIGN SPACING)

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**TABLE II**

| TABLE II | 30 | 35 | 45 | 50 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 105 | 110 | 115 | 120 | 125 | 130 | 135 | 140 | 145 | 150 | 155 | 160 | 165 | 170 | 175 | 180 | 185 | 190 | 195 | 200 | 205 | 210 | 215 | 220 | 225 | 230 | 235 | 240 | 245 | 250 | 255 | 260 | 265 | 270 | 275 | 280 | 285 | 290 | 295 | 300 | 305 | 310 | 315 | 320 |
|----------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|

### Table Notes:
- For PB (Flare Rate) See Table II and Note 1.
- See Notes 14B-14D.
NOTES:

DESIGN SPEED
1. The design speed used for taper rates should typically be the approximate legal speed, however, on construction projects for which the speed limit is reduced, the reduced speed should be used in determining the taper rate when the taper is not the first active construction area within the project.

TAPES
2A. The minimum acceptable rate for the shoulder taper is provided in Table II.

STOPLINE MARKINGS
3A. The work zone sign spacing shown in Table II are minimums. Maximum spacing should not be greater than 1.5 times the distances shown in Table I.
3B. Sign spacing should be adjusted to avoid conflict with existing signs. Minimum spacing for existing signs shall be 200' for speeds of 45 mph or less and a minimum of 400' for speeds 50 mph or greater.

ADJUSTMENTS FOR SIGHT DISTANCE
4. The location of the shoulder taper and the advance warning signs should be adjusted to provide for adequate sight distance for the existing vertical and horizontal roadway alignment.

BASE SIGNS
5A. ROAD WORK AHEAD (W20-4) signs shall be provided on entrance ramps or roadways entering the work limits.
5B. END ROAD WORK (W21-20) signs are only required for shoulder closures of more than a day. It is intended that these signs be placed on the median, on all exit ramps, and on roadways exiting the work limits.
5C. Overlapping of signing for adjacent projects should be avoided where the messages could be confusing. Any W27-1 or W27-2 signs which tails within the limits of another traffic control sign shall be offset or shifted during the period when both projects are active.

STOPLINE DETAILS
6A. When the approach speed is 40 mph or less, 36" STOP signs may be used.
6B. The distance plank W14-8 shall indicate the distance to the approach speed limit.

EXTRA ADVANCE WARNING SIGNS
1. Extra Advance Warning Signs consisting of ROAD WORK AHEAD (W20-4), RIGHT SHOULDER CLOSED (W21-23), and W20-4 signs plus distance control signs shall be as shown in Table I. A minimum of 5 drums in the taper shall be used to close the upstream shoulder.
1A. Cones may be substituted for drums as follows:
   a) Use of cones is permissible for either daytime operation or for nighttime operation, but shall not be used simultaneously, day and night, unless completion of work within the work period, the cones shall be 1 removed. They may be left placed on the highway in order to resume work in the following work period.
   b) Cones used for daytime traffic control shall have a minimum height of 24".
   c) Cones used for nighttime traffic control shall have a minimum height of 36".
   d) Cones placed on the right shoulder shall be prohibited on any shoulder on which a signed direction is approved for use of shoulder lane or detour.
   e) Cones spacing at night shall be at a maximum of 40', except in the case of drums placed on the right shoulder. Any cones which are in excess of the required distance shall be used in pairs, spaced 20' apart.
1B. Provisions shall be made to stabilize the cones and drums to prevent them from blowing over.

1C. All drums and cones should have a minimum height of 42".
1D. The use of drums or cones in lieu of portable barrier shall be based on engineering judgement.

PORTABLE BARRIERS (PB)
4A. A tapered and section may be used in place of the impact attenuator at locations where the last full section of PB can be extended outside of the clear zone for approaching traffic. See Table II for clear zone width. When a tapered and section is used, drums shall extend parallel to the travel lanes from the shoulder taper to the first section of PB parallel to the traveled lanes.
4B. If it is necessary to provide the Contractor with access to the work area behind the PB lanes, the PB end treatment shall include an impact attenuator. The maximum width of the opening shall be no less than the impact attenuator and the outside edge of the paved shoulder. Where space constraints do not allow for a PB between the lane line and attenuator, a minimum of 3' may be used.
4C. If the PB is placed within the clear zone of approaching traffic, the PB shall be determined from the calculations provided in SCD MT-95.47 and the L&D Manual, Volume I, Figure 602-A, and shall require the approval of the Engineer.
5A. When used, impact attenuators shall be installed parallel to traffic. Also, the last full section of PB, adjacent to the impact attenuator, shall be located parallel to traffic.
5B. Where narrow medians are provided, the advance warning signs shall be adjusted to provide for adequate sight distance for the existing vertical and horizontal roadway alignment.

SIGN SPACING
3A. The work zone sign spacings shown in Table II are minimums. Maximum spacing should not be greater than 1.5 times the distances shown in Table I. A minimum of 5 drums in the taper shall be used to close the upstream shoulder.
3B. Sign spacing should be adjusted to avoid conflict with existing signs. Minimum spacing for existing signs shall be 200' for speeds of 45 mph or less and a minimum of 400' for speeds 50 mph or greater.

INTERSECTION / SIDEWALK ACCESS
6A. All traffic zones shall be removed from outside of the clear zone for approaching traffic. See Table II for clear zone width. When a tapered and section is used, drums shall extend parallel to the travel lanes from the shoulder taper to the first section of PB parallel to the traveled lanes.
6B. If it is necessary to provide the Contractor with access to the work area behind the PB lanes, the PB end treatment shall include an impact attenuator. The maximum width of the opening shall be no less than the impact attenuator and the outside edge of the paved shoulder. Where space constraints do not allow for a PB between the lane line and attenuator, a minimum of 3' may be used.
6C. If the PB is placed within the clear zone of approaching traffic, the PB shall be determined from the calculations provided in SCD MT-95.47 and the L&D Manual, Volume I, Figure 602-A, and shall require the approval of the Engineer.
6D. When used, impact attenuators shall be installed parallel to traffic. Also, the last full section of PB, adjacent to the impact attenuator, shall be located parallel to traffic.
6E. Where narrow medians are provided, the advance warning signs shall be adjusted to provide for adequate sight distance for the existing vertical and horizontal roadway alignment.

BARRIERS
1A. Type A flashing warning lights shown on the ROAD WORK AHEAD (W20-4) signs and on the RIGHT SHOULDER CLOSED (W21-23) signs are required whenever a night low closure is necessary.
1B. Type A flashing warning lights shown on the ROAD WORK AHEAD (W20-4) signs and on the RIGHT SHOULDER CLOSED (W21-23) signs are required to be erected, as determined by the Engineer.
2A. The minimum acceptable rate for the shoulder taper is provided in Table II.
2B. The distance plaque W16-2aP shall indicate the distance to the shoulder taper.
2C. Distance plaques may be specified in the plans or may be required to be erected, as determined by the Engineer.
2D. Distance plaques may be specified in the plans or may be required to be erected, as determined by the Engineer.
2E. Distance plaques may be specified in the plans or may be required to be erected, as determined by the Engineer.
2F. Distance plaques may be specified in the plans or may be required to be erected, as determined by the Engineer.
2G. Distance plaques may be specified in the plans or may be required to be erected, as determined by the Engineer.
2H. Distance plaques may be specified in the plans or may be required to be erected, as determined by the Engineer.
2I. Distance plaques may be specified in the plans or may be required to be erected, as determined by the Engineer.
2J. Distance plaques may be specified in the plans or may be required to be erected, as determined by the Engineer.
2K. Distance plaques may be specified in the plans or may be required to be erected, as determined by the Engineer.
2L. Distance plaques may be specified in the plans or may be required to be erected, as determined by the Engineer.
2M. Distance plaques may be specified in the plans or may be required to be erected, as determined by the Engineer.
2N. Distance plaques may be specified in the plans or may be required to be erected, as determined by the Engineer.
2O. Distance plaques may be specified in the plans or may be required to be erected, as determined by the Engineer.
2P. Distance plaques may be specified in the plans or may be required to be erected, as determined by the Engineer.
2Q. Distance plaques may be specified in the plans or may be required to be erected, as determined by the Engineer.
2R. Distance plaques may be specified in the plans or may be required to be erected, as determined by the Engineer.
2S. Distance plaques may be specified in the plans or may be required to be erected, as determined by the Engineer.
2T. Distance plaques may be specified in the plans or may be required to be erected, as determined by the Engineer.
2U. Distance plaques may be specified in the plans or may be required to be erected, as determined by the Engineer.
2V. Distance plaques may be specified in the plans or may be required to be erected, as determined by the Engineer.
2W. Distance plaques may be specified in the plans or may be required to be erected, as determined by the Engineer.
2X. Distance plaques may be specified in the plans or may be required to be erected, as determined by the Engineer.
2Y. Distance plaques may be specified in the plans or may be required to be erected, as determined by the Engineer.
2Z. Distance plaques may be specified in the plans or may be required to be erected, as determined by the Engineer.

NOTES:

INTENDED USE

1. This Standard Construction Drawing (SCD) is intended for use as a supplement to SCDs MT-95.30, MT-95.31, MT-95.32, MT-95.40, and MT-95.41. It is not intended to be used as a stand-alone drawing.

GENERAL SIGNING

2A. Maximum spacing between adjacent signs in a series should not be greater than 1.5 times the distances specified in Table 1.

2B. END ROAD WORK (W20-2) signs are only required for lane closures of more than one day. If intended that these signs be placed on the mainline, an on-ramp or off-ramp, and on roadways exiting the work limits.

2C. Overlapping of signing for adjacent projects should be avoided where the messages could be confusing. Any W20-1 or G20-2 sign which falls within the limits of another traffic control zone shall be shifted or covered during the period when both projects are active.

2D. Median signing shall not apply to undivided highways.

2E. Provide the appropriate word or symbol legend necessary on speed reduction (W4-2, W50-2) signs to correctly identify which lane is to be closed.

2F. Signing for speed reduction and/or for increased penalties shall be provided when called for in the plans.

EXTRA ADVANCE WARNING SIGNS

3A. Extra Advance Warning Sign Groups consisting of ROAD WORK AHEAD (W20-1), LANE CLOSED AHEAD (W20-5) and WATCH FOR STOPPED TRAFFIC (W3-H4b) signs plus distance plaques may be specified in the plans or may be required to be erected, as determined by the Engineer.

3B. Installation of Extra Advance Warning Sign Groups shall not serve as a substitute for the standard advance signing group, beginning with the W20-4 sign, typically located at approximately 1 mile in advance of the beginning of the work area or the merge or shift taper.

3C. If a series of several Extra Advance Warning Sign Groups is provided in advance of the same work area or roadway restriction, the ROAD WORK AHEAD (W20-1) sign may be shifted from old but the first of the Extra Advance Warning Sign Groups in the series.
### TABLE I (SIGN SPACING)

<table>
<thead>
<tr>
<th>ROAD TYPE</th>
<th>DISTANCE BETWEEN SIGNS (FT)</th>
<th>A</th>
<th>B</th>
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### TABLE II

<table>
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<th>ROAD TYPE</th>
<th>SPEED LIMIT (MPH)</th>
<th>TAPER RATE (FT)</th>
<th>FLARE RATE (FT)</th>
<th>MAXIMUM DRUM SPACING (FT)</th>
<th>CLEAR ZONE WIDTH (FT)</th>
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**Legend**

- **Work Area**
- **Drums**
- **Flange Screen**
- **PB Tapered End**
- **Remove Existing Markings**
- **Direction of Travel**

**CROSSOVER DETAIL**

For RPM placement see Note 8.
NOTES:

1A. This Standard Construction Drawing (SCD) presents information which is applicable to crossover design. Additional information applicable to maintenance of traffic on multi-lane highways can be found on other MT-series SCD’s.

1B. SCD’s MT-01.50 and MT-01.70 shall be used with this drawing.

GENERAL

U. This Standard Construction Drawing (SCD) presents information which is applicable to crossover design. Additional information applicable to maintenance of traffic on multi-lane highways can be found on other MT-series SCD’s.

1A. This Standard Construction Drawing (SCD) presents information which is applicable to crossover design. Additional information applicable to maintenance of traffic on multi-lane highways can be found on other MT-series SCD’s.

1B. SCD’s MT-01.50 and MT-01.70 shall be used with this drawing.

TAPERS

3. The minimum acceptable length of taper shall be determined by multiplying the width of offset by the taper rate. The taper rate is provided in Table II.

SIGNING

4A. The Advisory Speed (W13-1P) plaque shall be used when specified on the plans.

4B. The work zone sign spacing shown in Table I are minimums. Minimum spacing should not be greater than 1.5 times the distances shown in Table I.

4C. Sign spacing should be adjusted to avoid conflict with existing signs. Minimum spacing to existing signs shall be 500’ for speeds of 45 mph or less and a minimum of 400’ for speeds of 55 mph or greater.

4D. Sign locations should be adjusted to provide adequate sight distance for the existing vertical and horizontal roadway alignment.

4E. If the tangent distance along the temporary diversion is less than 2000’, the second Reverse Curve (W1-4) sign may be used in place of the first Reverse Curve (W1-4) sign.

4F. If the tangent distance along the temporary diversion is less than 2000’, the second Reverse Curve (W1-4) sign may be used in place of the first Reverse Curve (W1-4) sign.

4G. The SINGLE LANE (W6-H3b) signs shall be provided along the tangent section when specified on the plans.

4H. Any END ROAD WORK (G20-2) signs which would fall within the limits of another work zone may be omitted.

5. The minimum acceptable length of taper shall be determined by multiplying the width of offset by the taper rate. The taper rate is provided in Table II.

5A. Work zone edge lines shall be provided along the tangent section when specified on the plans.

5B. Work zone edge lines shall be provided along the tangent section when specified on the plans.

5C. Work zone pavement markings which would conflict with the final traffic lanes shall be removable tape (CMS 746.06, Type II) unless the area will be restorated prior to project completion.

5D. During completion of the work, pavement markings other than CMS 700.00, Type I shall be removed in accordance with CMS 614.00. The original markings and raised pavement marker reflectors shall be restored at no additional cost unless separately itemized in the plans.

5E. Edge lines shall be of the appropriate color for the direction of travel. If the temporary edge lines are located on the same alignment as existing lines, the temporary edge lines shall be painted over top of the existing lines with subsequent over-painting if necessary during the life of the work stage to maintain day and night colors if different than on the final surface. If on the final surface, all marking shall be removable tape per Note 5C above.

PORTABLE BARRIER (PB)

6A. The PB near the exiting crossover shall extend straight on the permanent roadway to 450’ beyond the PC of the crossover. The PB shall then be graded at 10:1 or flatter. If the cross slope is greater than 10:1, the PB shall be extended along the paved shoulder, from PC to end of barrier.

6B. The PB shall be at least 32”. Any barrier less than 32” shall be fitted with glare screen when there is live traffic on both sides.

6C. PB near the exiting crossover shall extend straight on the permanent roadway to 450’ beyond the PC of the crossover. The PB shall then be graded at 10:1 or flatter. If the cross slope is greater than 10:1, the PB shall be extended along the paved shoulder, from PC to end of barrier.

6D. Edge lines shall be of the appropriate color for the direction of travel. If the temporary edge lines are located on the same alignment as existing lines, the temporary edge lines shall be painted over top of the existing lines with subsequent over-painting if necessary during the life of the work stage to maintain day and night colors if different than on the final surface. If on the final surface, all marking shall be removable tape per Note 5C above.

6E. When used, impact attenuators shall be installed parallel to traffic. The last full section of PB adjacent to the impact attenuator shall be installed parallel to traffic. For installation procedures, refer to the manufacturer’s installation instructions.

6F. No reflectors or other channelizing devices shall be permitted on the face of the PB facing the exiting traffic.

6G. All other drum spacing shall be per Table II.

6H. For details on delineation of PB, see SCD MT-101.70.

6I. PB near the exiting crossover shall extend straight on the permanent roadway to 450’ beyond the PC of the crossover. The PB shall then be graded at 10:1 or flatter. If the cross slope is greater than 10:1, the PB shall be extended along the paved shoulder, from PC to end of barrier.

6J. PB near the exiting crossover shall extend straight on the permanent roadway to 450’ beyond the PC of the crossover. The PB shall then be graded at 10:1 or flatter. If the cross slope is greater than 10:1, the PB shall be extended along the paved shoulder, from PC to end of barrier.

6K. PB near the exiting crossover shall extend straight on the permanent roadway to 450’ beyond the PC of the crossover. The PB shall then be graded at 10:1 or flatter. If the cross slope is greater than 10:1, the PB shall be extended along the paved shoulder, from PC to end of barrier.

6L. PB near the exiting crossover shall extend straight on the permanent roadway to 450’ beyond the PC of the crossover. The PB shall then be graded at 10:1 or flatter. If the cross slope is greater than 10:1, the PB shall be extended along the paved shoulder, from PC to end of barrier.

6M. PB near the exiting crossover shall extend straight on the permanent roadway to 450’ beyond the PC of the crossover. The PB shall then be graded at 10:1 or flatter. If the cross slope is greater than 10:1, the PB shall be extended along the paved shoulder, from PC to end of barrier.

6N. PB near the exiting crossover shall extend straight on the permanent roadway to 450’ beyond the PC of the crossover. The PB shall then be graded at 10:1 or flatter. If the cross slope is greater than 10:1, the PB shall be extended along the paved shoulder, from PC to end of barrier.

6O. PB near the exiting crossover shall extend straight on the permanent roadway to 450’ beyond the PC of the crossover. The PB shall then be graded at 10:1 or flatter. If the cross slope is greater than 10:1, the PB shall be extended along the paved shoulder, from PC to end of barrier.

6P. PB near the exiting crossover shall extend straight on the permanent roadway to 450’ beyond the PC of the crossover. The PB shall then be graded at 10:1 or flatter. If the cross slope is greater than 10:1, the PB shall be extended along the paved shoulder, from PC to end of barrier.

6Q. PB near the exiting crossover shall extend straight on the permanent roadway to 450’ beyond the PC of the crossover. The PB shall then be graded at 10:1 or flatter. If the cross slope is greater than 10:1, the PB shall be extended along the paved shoulder, from PC to end of barrier.

6R. PB near the exiting crossover shall extend straight on the permanent roadway to 450’ beyond the PC of the crossover. The PB shall then be graded at 10:1 or flatter. If the cross slope is greater than 10:1, the PB shall be extended along the paved shoulder, from PC to end of barrier.

6S. PB near the exiting crossover shall extend straight on the permanent roadway to 450’ beyond the PC of the crossover. The PB shall then be graded at 10:1 or flatter. If the cross slope is greater than 10:1, the PB shall be extended along the paved shoulder, from PC to end of barrier.

TRANSITION AREA DELINEATION

8. Transition area delineation shall be provided per SCD MT-99.50, or as otherwise specified in the plans.

LIGHTING

9. Work zone lighting shall be provided per SCD MT-000.00.

GEOMETRIES

10. Geometrics of the crossover shall be as specified in the plans.
LEGEND

WORK AREA
DRUMS
PB WITH CLARE SCREEN
TAPERED END
REMOVAL EXISTING MARKINGS
DIRECTION OF TRAVEL

CROSSOVER DETAIL

For RPM placement see Note 8.

TABLE I (SIGN SPACING)

<table>
<thead>
<tr>
<th>ROAD TYPE</th>
<th>DISTANCE BETWEEN SIGNS (FT)</th>
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<tr>
<td>A</td>
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TABLE II

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</table>

See Notes 6C, 6D
NOTES:

GENERAL

1. This Standard Construction Drawing (SCD) presents information that is applicable to crossover design. Additional information applicable to maintenance is not included in this SCD.

2. SCD's MT-01.50 and MT-01.70 shall be used with this drawing.

DESIGN SPEED

2. The design speed used for taper rates should typically be the permanent legal speed. However, on construction projects where the speed limit is reduced, the reduced speed may be used in determining the taper rate when the taper is not the first active construction area within the project.

TAPERS

3. The minimum acceptable length of taper shall be determined by multiplying the width of the cross slope by the taper rate. The taper rate is provided in Table II.

SIGNING

4A. The Advisory Speed (W13-1P) plaque shall be used when specified in the plans.

4B. The work zone sign spacing shown in Table I are minimums. Maximum spacing shall not be greater than 1.5 times the distances shown in Table I.

4C. Sign spacing should be adjusted to avoid conflict with existing signs. Minimum spacing to existing signs shall be 200 ft for speeds of 45 mph or less and a minimum of 400 ft for speeds of 55 mph or greater.

4D. Sign locations should be adjusted to provide adequate sight distance for the existing vertical and horizontal roadway alignment.

4E. If the tangent distance along the temporary diversion is less than 2000 ft, place the second Reverse Curve (W4-3b) sign at the midpoint of the tangent.

4F. If the tangent distance along the temporary diversion is 600 ft or less, the Double Reverse Curve (W4-3b) signs may be used in place of the first Reverse Curve sign, eliminating the need for the second Reverse Curve sign.

4G. The SINGLE LANE (W6-H3b) signs shall be provided along directional single-lane roadways over 3 miles. Spacing of the W6-H3b sign shall be approximately nine intervals.

4H. Any END ROAD WORK (W20-2) signs which would fall within the limits of another work zone may be omitted.

PAVEMENT MARKING

5A. The existing conflicting pavement markings and reflectors from the raised pavement markers shall be removed and the appropriate color work zone edge lines shall be applied.

5B. Work zone edge lines shall be provided along the tangent section when specified in the plans.

5C. Work zone pavement markings which would conflict with the final traffic lanes shall be removable tape CMS 740-06, Type II unless the area will be resurfaced prior to project completion.

5D. After completion of the work, pavement markings other than CMS 740-06, Type II shall be removed in accordance with CMS 614.11. The original markings and raised pavement marker reflectors shall be restored at no additional cost unless separately inventorized in the plans.

5E. Edge lines shall be of the appropriate color for the direction of travel. If the temporary edge lines are located on the same alignment as existing lines, the temporary line shall be joined end to end with the existing lines (with subsequent over-painting if necessary during the life of the work stage to maintain day and night color if other than on the final surface). If the final surface, all marking shall be removed tape per note 5C above.

PORTABLE BARRIER (PB)

6A. The PB near the exiting crossover shall extend straight on the permanent roadway to 400 ft beyond the IC of the crossover. The PB shall then be flattened at the rate specified in Table II.

6B. The PB shall be at least 32". Any barrier less than 32" shall be fitted with glare screens when there is live traffic on both sides.

6C. PB end treatment may be by tapered ends if located beyond the clear zone of approaching traffic.

6D. PB end treatment may be by flared ends if located within the clear zone of approaching traffic.

6E. PB end treatment may be by tapered ends if located beyond the clear zone of approaching traffic.

6F. PB end treatment may be by flared ends if located within the clear zone of approaching traffic.

6G. Where PB is located beyond the edge of the paved shoulder, the cross slope within the clear zone, including the surface on which the PB is placed, shall be graded at 10% or flatter. If the cross slope is steeper than 10%, the PB shall be terminated on the paved shoulder. The PB shall be extended along the paved shoulder as necessary, to satisfy the length of need, and then terminated using an impact attenuator.

6H. For details on delineation of PB, see SCD MT-01.70.

GEOMETRICS

1A. This Standard Construction Drawing (SCD) presents information which is applicable to crossover design. Additional information applicable to maintenance is not included in this SCD.

1B. SCD’s MT-101.60 and MT-101.70 shall be used with this drawing.

1C. Work zone pavement markings which would conflict with the final traffic lanes shall be removable tape CMS 740-06, Type II unless the area will be resurfaced prior to project completion.

1D. After completion of the work, pavement markings other than CMS 740-06, Type II shall be removed in accordance with CMS 614.11. The original markings and raised pavement marker reflectors shall be restored at no additional cost unless separately inventorized in the plans.

1E. Edge lines shall be of the appropriate color for the direction of travel. If the temporary edge lines are located on the same alignment as existing lines, the temporary line shall be joined end to end with the existing lines (with subsequent over-painting if necessary during the life of the work stage to maintain day and night color if other than on the final surface). If the final surface, all marking shall be removed tape per note 5C above.

1F. The Advisory Speed (W13-1P) plaque shall be used when specified in the plans.

1G. The work zone sign spacing shown in Table I are minimums. Maximum spacing shall not be greater than 1.5 times the distances shown in Table I.

1H. Sign spacing should be adjusted to avoid conflict with existing signs. Minimum spacing to existing signs shall be 200 ft for speeds of 45 mph or less and a minimum of 400 ft for speeds of 55 mph or greater.

1I. Sign locations should be adjusted to provide adequate sight distance for the existing vertical and horizontal roadway alignment.

1J. If the tangent distance along the temporary diversion is less than 2000 ft, place the second Reverse Curve (W4-3b) sign at the midpoint of the tangent.

1K. If the tangent distance along the temporary diversion is 600 ft or less, the Double Reverse Curve (W4-3b) signs may be used in place of the first Reverse Curve sign, eliminating the need for the second Reverse Curve sign.

1L. The SINGLE LANE (W6-H3b) signs shall be provided along directional single-lane roadways over 3 miles. Spacing of the W6-H3b sign shall be approximately nine intervals.

1M. Any END ROAD WORK (W20-2) signs which would fall within the limits of another work zone may be omitted.

1N. Drums along the crossover curves shall be spaced at 30' center-to-center.

1O. Drums used to close off a crossover shall be spaced at 30' center-to-center.

1P. All other drum spacing shall be per Table II.

1Q. Drums located along the crossover ramps should be placed on the aggregate shoulder as close as possible to the face of the W6-H3b sign at the midpoint of the tangent.

1R. Drums located within the clear zone of approaching traffic shall be placed on the aggregate shoulder as close as possible to the midpoint of the W6-H3b sign at the midpoint of the tangent.

1S. Drums located on existing shoulders less than 10' wide shall be placed on the aggregate shoulder as close as possible to the midpoint of the W6-H3b sign at the midpoint of the tangent.

1T. Geometrics of the crossover shall be as specified in the plans.

EXISTING TRANSITIONAL REFLECTIVE STRIPES

2A. Existing longitudinal reflective stripes located within the crossover alignment shall be eliminated by pavement planing and resurfacing.
See Table II For Taper Rate

See Notes 6H-6J

See Notes 8A and 8B For Transition Area Delineation

For Flare Rates

See Table II For Clear Zone Width

See Notes 6C, 6D For End Treatment

Traffic Control per MT-102.20

End Treatment

Legend:
- Work Area
- Portable
- Barriers (PB)
- PB with Glare Screen
- Tapered End Attenuator
- PCB "Y" Connecting Segment
- Remove Existing Markings
- Direction of Travel
GENERAL

14. This Standard Construction Drawing (SCD) presents information which is applicable to crossovers design. Additional appropriate supplemental drawings will be published for multimodal traffic on multi-lane highways can be found on the MT-95.20 and MT-95.40 series drawings.

15. SCD MT-90.70 shall be used with this drawing.

DESIGN SPEED

2. The design speed used for taper rates should typically be the permanent legal speed. However, on construction projects for which the speed limit is reduced, the reduced speed may be used for determining the taper rate when the taper is not the first active construction area within the project.

TAPERS

3. The minimum acceptable length of taper shall be determined by multiplying the width of the taper by the taper ratio. The taper ratio is provided in Table II.

SIGNING

4A. The Advisory Speed (WS-H3b) plaque shall be used when specified in the plans.

4B. The spacing between work zone signs, as shown in Table I, is minimums. Maximum spacing should not be greater than 1.5 times the distances shown in Table I.

4C. Sign spacing should be adjusted to avoid conflict with existing signs. Minimum spacing to existing signs shall be 200' for speeds of 40 mph or less and 100' for speeds over 40 mph.

4D. Sign locations should be adjusted to provide adequate sight distance for the existing vertical and horizontal alignment.

4E. If the tangent distance along the temporary diversion is less than 6000', place the second reverse curve sign at the midpoint of the tangent.

4F. If the tangent distance along the temporary diversion is 6000' or less, then the double Reverse Curve (WS-H3b) sign shall be placed in the median of the first Reverse Curve sign, eliminating the need for the second reverse Curve sign.

4G. The SINGLE LANE MEDIAN CROSSOVER (WS-H4b) sign shall be provided along directional single-lane roadways over 3 miles. Spacing of the WS-H4b shall be of approximately 1 mile.

4H. A diagrammatic sign shall be provided when detailed in the plans. Otherwise, the experimental sign shown in Table I shall be provided. In agreement by the Office of roadway engineering administration.

4I. The LANE 1 SIGNS and the diagrammatic sign shall be placed within lanes or adjacent to lanes such as it will be visible to oncoming traffic. These signs shall be placed left of signs on right.

4J. The sight of the road shall be the same as described in the plan. Signing shall specify which are not accessible from the crossover lane.

4K. Additional information shall be provided in the form of fixed signs and changeable message boards as called for in the plans.

4L. Sign spacing on major conventional highways shall be as called for in Table 1 for freeway and expressway spacing unless otherwise determined by the Engineer.

PAVEMENT MARKINGS

5A. The existing conflicting pavement markings and reflectors from the temporary pavement markings shall be removed and the appropriate color work zone edge lines shall be added as shown. Where the temporary markings shall be shown, the appropriate color work zone edge lines shall be added as shown.

5B. Work zone edge lines shall be provided along the tangent section when called for in the plans.

5C. Work zone pavement markings which would conflict with the Plans shall be removed. See CMS 140-66, Style I D type unless the area will be recentered or to project boundary.

5D. After completion of the work, pavement markings other than CMS 140-66, Style I D type shall be removed in accordance with CMS 95.10. The original markings and raised pavement reflectors shall be restored at no additional cost unless separately itemized in the plans.

5E. Edge lines shall be of the appropriate color for the direction of travel. If the temporary edge lines are not on the alignment as existing lines, the temporary lines may be placed over top of the existing lines with subsequent overpainting if necessary during the life of the work stage to maintain day and night color if other than as shown in the plans. It is common practice to install reflective pavement marking tapes as per Note 5C above.

5F. A Vertically channelizing line shall be provided in between the crossover lane and the through lane in advance of the work zone, as shown on sheet 5 of 7. All other channelizing lines shown on this drawing shall be of standard 8" width.

5G. If the intended location of the beginning of the channelizing line, as called for in the detail, is on a curve, then the beginning of the channelizing line shall be located from the curve to a distance of 500'.

5H. If the beginning of the channelizing line would be located near an exit ramp, then the beginning of the channelizing line shall be from the end of the channelizing line, as called for in the detail, on a curve.

5I. Channelizing line. The minimum length of exit ramps are 40' wide lanes and are placed at the spacing shown in SCD 10-75.

PORTABILITY (cont.)

5J. The PB near the exiting crossover shall extend along the crossover lane and the through lanes. The PB shall then be aligned for the PB roadbed specified in Table II.

5K. The PB shall be 3'5' tall, fitted with glare screen, or may be 3'0' high with CMS 300 compliant.

5L. PB and impact attenuator shall be installed adjacent to the work zone. If located within the clear zone of approaching traffic, the PB shall be installed at the median of the crossover lane and the through lanes.

5M. PB and treatment must be by tapered ends if located more than the clear zone of approaching traffic.

5N. PB and impact attenuator shall be installed parallel to traffic. The last full section of PB and impact attenuator shall be joined parallel to traffic. For installation procedures, refer to manufacturer's installation instructions.

5O. No reflectors or other channelizing devices shall be permitted on the crossover. The PB facing the existing crossover, PB to end of barrier.

5P. PB shall be installed.

6A. Where PB is provided at the gore, the impact attenuator shall be installed parallel to traffic.

6B. Where the impact attenuator is intended to apply to two barriers within the gore, one from the through lane and one from the crossover, the two barriers shall be joined to form one using a PCB "Y" connecting segment. For the "Y" detail, see roadway plan for PB "Y" Connector Segment.

6C. Contractors may choose to install a wide impact attenuator in lieu of utilizing the standard "Y" segment. For example, a wide impact attenuator of a minimum of 40' wide at the gore, the roadway could be installed in place of the gore (defined as the gore in gore impact attenuator, Q3 PCB "Y" connector segment and Q4 one standard PCB section. However, if contractors use this connection method, the wide impact attenuator must still be manufactured in accordance with awards 300 and/or 35-09 and installed as per manufacturer's instructions.

6D. If using steel barrier, the contractor shall install the wide impact attenuator option as detailed above, ensuring that all connections are maintained per the manufacturer's specifications.

6E. The contractor shall reconfigure a damaged PB within 24 hours of a damaging impact.

6F. Where a PCB "Y" connector segment is provided, one standard section of PCB shall be provided between the "Y" connector segment and the impact attenuator.

6G. Connection of the impact attenuator to the PB shall be by positive connection. Appropriate crashworthy tie-downs used to reframe the impact attenuator and the first PB shall be installed.

6H. Where a PB is located beyond the edge of the paved shoulder, the cross along with the approach, including the surface on which the PB is placed, shall be filled. If the PB is deeper than 300', the edging shall be extended to the paved shoulder in advance. If the secondary shoulder is not provided as required, it is necessary to extend the length of the PB to the paved shoulder in advance. If PB is located near an exit ramp, then the PB shall be extended along the plan shoulder as necessary to satisfy the length of the PB.

6I. Where a PB is located beyond the edge of the paved shoulder, the cross along with the approach, including the surface on which the PB is placed, shall be filled. If the PB is deeper than 300', the edging shall be extended to the paved shoulder in advance. If the secondary shoulder is not provided as required, it is necessary to extend the length of the PB to the paved shoulder in advance. If PB is located near an exit ramp, then the PB shall be extended along the plan shoulder as necessary to satisfy the length of the PB.

6J. Where a PB is located beyond the edge of the paved shoulder, the cross along with the approach, including the surface on which the PB is placed, shall be filled. If the PB is deeper than 300', the edging shall be extended to the paved shoulder in advance. If the secondary shoulder is not provided as required, it is necessary to extend the length of the PB to the paved shoulder in advance. If PB is located near an exit ramp, then the PB shall be extended along the plan shoulder as necessary to satisfy the length of the PB.

6K. Where a PB is located beyond the edge of the paved shoulder, the cross along with the approach, including the surface on which the PB is placed, shall be filled. If the PB is deeper than 300', the edging shall be extended to the paved shoulder in advance. If the secondary shoulder is not provided as required, it is necessary to extend the length of the PB to the paved shoulder in advance. If PB is located near an exit ramp, then the PB shall be extended along the plan shoulder as necessary to satisfy the length of the PB.

6L. Where a PB is located beyond the edge of the paved shoulder, the cross along with the approach, including the surface on which the PB is placed, shall be filled. If the PB is deeper than 300', the edging shall be extended to the paved shoulder in advance. If the secondary shoulder is not provided as required, it is necessary to extend the length of the PB to the paved shoulder in advance. If PB is located near an exit ramp, then the PB shall be extended along the plan shoulder as necessary to satisfy the length of the PB.
This drawing replaces MT-95.73 dated 01-20-2017.

OFFICE OF ROADWAY ENGINEERING

SOISSON

David L. Holstein

07-27-2017
NOTES:

GENERAL

16. This Standard Construction Drawing (SCD) presents information which is applicable to crossover design, and additional information, applicable to maintenance of traffic on multi-lane highways can be found in the MT-91 series. Signing shall specify which exits are not accessible to the taper rate when the taper is not the permanent legal speed. However, on temporary alignment of the crossover, shall be eliminated by paving planing and paving.

17. This Drawing Replaces MT-95.73 Dated 01-20-2017. SCD Number MT-95.73 Office of Engineering 07-21-2017 Sodson.

DESIGN SPEED

2. The design speed used for taper rates should typically be the permanent legal speed, however, on construction projects for which the speed is reduced, the reduced speed may be used in determining the taper rates. When the taper rate is not the taper rate, the taper rate is provided in Table II.

SIDING

44. The Advisory Speed MT-101 plaque shall be used when specified in the plan.

45. The spacing between work zone signs, as shown in Table I, are minimum. Minimum spacing should not be greater than 1.5 times the distance shown in Table I.

46. Sign spacing should be avoided to conflict with existing signs. Minimum spacing to existing signs shall be 300’ for speeds of 45 mph or less and a minimum of 400’ for speeds 50 mph or greater.

47. Sign locations should be adjusted to provide adequate sight distance to existing horizontal and vertical road alignment.

48. If the tangent distance along the temporary diversion is less than 2000’, place the second Reverse Curve sign (MT-4) sign of the midpoint of the tangent.

49. If the tangent distance along the temporary diversion is 2000’ or less, then the double Reverse Curve sign (MT-4) sign may be used in place of the first Reverse Curve sign, eliminating the need for the second Reverse Curve sign.

50. The SINGLE LANE (MT-40) sign shall be provided along construction projects for over 3 miles. Spacing of the MT-40 sign shall be approximately 1 mile.

51. Diagrammatic guide signs and interchange guide signs shall be provided as detailed in the plans.

52. The guide signs shall have black legends on orange background. These signs shall be 15” x 24” signs on sign posts. The size of the signs based on Level I sign designs shall be specified in the plans.

53. Sign testing for exit ramps located within the limits of the crossover lane shall be shown on the plan. The capacity of the existing lanes are not accessible from the crossover lane.

54. Additional information should be provided in the form of fixed signs and/or changeable message boards as called for in the plans.

55. Sign spacing on major conventional highways shall be provided on 2 Laner Crossings. Sign spacing shall be expressway spacing unless otherwise determined by the Engineer.

PAVEMENT MARKINGS

59. The existing conflicting pavement markings and reflectors from the raised pavement markers (RPM) shall be removed prior to the beginning of the "exit" gore, as shown on sheet 2 of 4. All other channelizing lines shown on this drawing will be standard width.

60. If the intended location of the beginning of the channelizing line, as shown in Table I, is used, then the temporary markings may be overlaid on top of the existing lines, with additional overlapping if necessary during the lane shift and the work stage 1 of 3, maintain a "right-of-way" if other than on the final surface. If on the final surface, marking will be removed tops as per Table III.

61. A 0” channelizing line shall be provided in between the crossover line and the through lane in advance of the “exit” gore, as shown on sheet 2 of 4. All other channelizing lines shown on this drawing will be standard width.

62. If the intended location of the beginning of the channelizing line, as shown in Table I, is used, then the temporary markings may be overlaid on top of the existing lines, with additional overlapping if necessary during the lane shift and the work stage 1 of 3, maintain a "right-of-way" if other than on the final surface. If on the final surface, marking will be removed tops as per Table III.

63. Clearances in markings on area of exit ramps are 3” wide lines and are placed at the spacing shown in SCD MT-91.50.

PORTABLE BARRIER (PB)

65. PB near the exiting crossover shall extend to the end of the permanent roadway, as shown on the plan. The PB shall be placed at the end of the rate specified in Table II.

66. The PB shall be 32” wide, filled with gravel, soil, or may be 24” wide if KCMP 955 compliant.

67. PB and treatment shall be by impact attenuator if located within the clear zone of approaching traffic.

68. PB and treatment may be by tapered ends if located beyond the clear zone of approaching traffic.

69. When used, impact attenuators shall be installed adjacent to the PB in the following manner. The minimum height of PB shall be installed parallel to the PB in the “Y” segment, as per manufacturer’s installation instructions.

70. No reflectors or other channelizing devices shall be placed in the face of the PB facing the exiting crossover, from PC 30’ to end of barrier.

71. Where PB is provided on the gore, the impact of PB shall be extended parallel to mainline traffic.

PB (cont.)

72. Where the impact attenuator is intended to apply to two barriers within the gore, one from the through lane and one from the exiting crossover, the two PB’s shall be joined to form one unit using a PB “Y” connector segment. For the "Y" connector segment, the work zone impact attenuator shall be installed in accordance with CMS 614.11.

73. Connection of the impact attenuator to the PB shall be by bolt connection. Appropriate crosswelding transitions between the impact attenuator and the PB shall be installed.

74. Where a PB is located beyond the edge of the paved shoulder, the crosswelds within the clear zone, including the surface on which the PB is placed, shall be at least 90° or flat bar. The crosswelds shall be extended along the paved shoulder to the edge of the paved shoulder. The PB shall be extended along the paved shoulder to a sufficient length to ensure that all connections are made per the manufacturer’s specifications.

75. Where a PB is located beyond the edge of the paved shoulder, the crosswelds within the clear zone, including the surface on which the PB is placed, shall be at least 90° or flat bar. The crosswelds shall be extended along the paved shoulder to the edge of the paved shoulder. The PB shall be extended along the paved shoulder to a sufficient length to ensure that all connections are made per the manufacturer’s specifications.

76. The PB shall be extended along the paved shoulder to a sufficient length to ensure that all connections are made per the manufacturer’s specifications.

77. Connection of the impact attenuator to the PB shall be by bolt connection. Appropriate crosswelding transitions between the impact attenuator and the PB shall be installed.

78. Where PB is provided on the gore, the impact of PB shall be extended parallel to mainline traffic.

79. PAVERS shall be from the through lane and one from the exiting crossover, the two PB’s shall be joined to form one unit using a PB “Y” connector segment. For the “Y” connector segment, the work zone impact attenuator shall be installed in accordance with CMS 614.11.

80. Connection of the impact attenuator to the PB shall be by bolt connection. Appropriate crosswelding transitions between the impact attenuator and the PB shall be installed.

81. Where PB is provided on the gore, the impact of PB shall be extended parallel to mainline traffic.

82. Where the impact attenuator is intended to apply to two barriers within the gore, one from the through lane and one from the exiting crossover, the two PB’s shall be joined to form one unit using a PB “Y” connector segment. For the “Y” connector segment, the work zone impact attenuator shall be installed in accordance with CMS 614.11.

83. Connection of the impact attenuator to the PB shall be by bolt connection. Appropriate crosswelding transitions between the impact attenuator and the PB shall be installed.

84. Where PB is provided on the gore, the impact of PB shall be extended parallel to mainline traffic.

FOUR LANE CROSSING:

85. Where the impact attenuator is intended to apply to two barriers within the gore, one from the through lane and one from the exiting crossover, the two PB’s shall be joined to form one unit using a PB “Y” connector segment. For the “Y” connector segment, the work zone impact attenuator shall be installed in accordance with CMS 614.11.

86. Connection of the impact attenuator to the PB shall be by bolt connection. Appropriate crosswelding transitions between the impact attenuator and the PB shall be installed.

87. Where PB is provided on the gore, the impact of PB shall be extended parallel to mainline traffic.

EXISTING LONGITUDINAL RUMBLE STRIP

88. Existing longitudinal rumble strips, located within the alignment of the crossover, shall be eliminated by paving planing and paving.

LIGHTING

89. Work zone lighting shall be provided as per SCD MT-100.00.
WITH DEDICATED TURN LANE

**TABLE I (SIGN SPACING)**

<table>
<thead>
<tr>
<th>ROAD TYPE</th>
<th>DISTANCE BETWEEN SIGNS (FT)</th>
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<tr>
<td>URBAN (65 MPH)</td>
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**TABLE II**

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<th>Shoulder Taper Rate (MIN)</th>
<th>Maximum Drum Spacing (FT)</th>
<th>Buffer (FT)</th>
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</table>

**Legend**

- Type III Barricade
- WITH SIGN
- Type B Flashing (Yellow)
- Warning Light
- RAMP CLOSED

For areas without a dedicated turn lane, the closure set-up is as shown on this sheet.

For areas with drop lanes, see Sheet 2.

If the directions of traffic are separated by a two-way left turn lane or any other traversable pavement, omit the temporary sign(s) shown in the median.

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For areas without a dedicated turn lane, the closure set-up is as shown on this sheet.

For areas with drop lanes, see Sheet 2.

If the directions of traffic are separated by a two-way left turn lane or any other traversable pavement, omit the temporary signs shown in the median.
NOTES:

DESIGN SPEED

1. The design speed used for taper rates should typically be the permanent legal speed. However, on construction projects for which the speed limit is reduced, the reduced speed may be used in determining the taper rate when the taper is not the first active construction area within the project.

TAPERS

2A. The minimum acceptable length for the merge taper shall be determined by multiplying the width of offset by the merging taper rate. The merge taper rate is provided in Table 2.

2B. The minimum acceptable length for the shoulder taper shall be determined by multiplying the width of the shoulder by the shoulder taper rate. The shoulder taper rate is provided in Table 2.

SIGN SPACING

3A. The work zone sign spacings shown in Table 1 are minimums. Maximum spacing should not be greater than 1.5 times the distances shown in Table 1.

3B. Sign spacing should be adjusted to avoid conflict with existing signs. Minimum spacing to existing signs shall be 300' for speeds of 40 mph or less and a minimum of 400' for speeds of 50 mph or greater.

ADJUSTMENTS FOR SIGHT DISTANCE

4. The location of the merging taper and the advance warning signs should be adjusted to provide for adequate sight distance for the existing vertical and horizontal roadway alignment.

BASIC SIGNING

5A. ROAD WORK AREA (W00-0) signs shall be provided on both sides of the roadway for the entire work limits.

5B. END ROAD WORK (W00-2) signs are only required for ramp closures of more than 3 days. It is intended that these signs be placed on the main roadway intersecting the entrance ramp.

5C. Overlapping of signing for adjacent projects should be avoided where the messages could be confusing. Any W00-0 or W00-2 signs which falls within the limits of another traffic control zone shall be omitted or covered during the period when both projects are active.

5D. On multi-lane divided roadways without a dual left turn lane, work zone signs shall be added in the median.

SIGN DETAILS

6A. The advisory speed W03-01 plaque shall be used when specified in the plan.

6B. When the approach speed limit is 40 mph or less, extra warning signs may be used.

6C. The distance plaque W6-55 or W6-58 if the distance shown is in feet shall indicate the distance to the beginning of the merging taper. Distances less than 1 mile may be expressed in feet. The plaque may be omitted if Extra Advance Sign Groups are not used.

6D. Place a CLOSED W20-07A overlay diagonally across all overhead guide signs pertaining to the closed entrance ramp when the entrance is expected to be closed for more than 3 days. Match the design level of the overlay with the design level of the existing overhead sign.

6E. Provide detour signage to direct to alternate routes as determined by the Engineer or as specified in the plans.

6F. Notice of Closure Signs W20-06b will be erected by the Contractor at least one week in advance of the scheduled road or ramp closure. The signs shall be erected on the right-hand side of the roadway facing traffic. They shall be placed so as not to interfere with the visibility of any other traffic control signs. The signs may be erected anywhere on ramps as long as they are visible to the motorists using the ramps and well in advance of the merge area to avoid distracting motorists.

PAVEMENT MARKINGS / RPMs

7A. If the construction operation requires a lane closure for more than 1 day, the existing conflicting reflectors shall be removed from the raised pavement markers (RPMs).

7B. Additionally, if a lane closure of greater than 3 days is required, the following shall be performed:
   a) the appropriate color work zone edge lines shall be applied along the taper and tangent sections,
   b) the existing conflicting pavement markings shall be removed or covered per CMS 614.15,
   c) Work zone dotted lines, 3" in length separated by 8' gaps, shall be provided to identify the merge.

7C. Work zone pavement markings which would conflict with final traffic lanes shall be removable type CMS 614.05 Type II unless the area will be resurfaced prior to project completion.

7D. After completion of the work, pavement markings other than CMS 614.05, Type I shall be removed in accordance with CMS 614.11. The original markings and raised pavement marker reflectors shall be restored at no additional cost unless separately itemized in the plans.

ARROW BOARD

8. The arrow board shall be chosen from the ODOT approved list and follow the guidelines in Supplemental Specifications 801 and 802.

FLASHING WARNING LIGHTS

9. Type A flashing warning lights shown on the ROAD WORK AREAS (W00-0), RAMP CLOSED (E5-H2e), RAMP CLOSED AHEAD (E5-H2f) and LANE CLOSED AHEAD (W20-5) signs are required whenever a night lane closure is necessary.

CRANES / CONES

10A. The maximum crane spacing along tapers and along tangent sections shall be as shown in Table 2. A minimum of 3 cranes shall be used to close the upstream shoulder of the downstream taper drum spacing shall be approximately 20'.

10B. Cones may be substituted for drums as follows:
   a) use of cones is permissible for either daytime operation or for nighttime operation, but shall not be used continuously, day and night, upon completion of work within the work period, the cones shall be removed. They may again be placed on the highway in order to resume work in the following work period.
   b) Cones used for daytime traffic control shall have a minimum height of 28".
   c) Cones used for nighttime traffic control shall have a minimum height of 42".
   d) Use of cones of night shall be prohibited along tapers.
   e) Cone spacing shall match the drum spacing in Table 2.
   f) Where cones are substituted for drums along tangents, intermixing of channelizing devices within the same run will not be permitted. Either cones shall be used for the entire length of the tangent section, or drums shall be used for the entire length.

10C. Provisions shall be made to stabilize the cones and drums to prevent them from blowing over.

10D. Drums shall not encroach into the opposing lane of traffic. If drums encroach into the opposite lane, the lane shall be closed.

ARCHITECTURAL AND ENGINEERING SERVICES

SOSON
PAVEMENT MARKING OPERATION PROCEDURES

NOTES:

GENERAL
1. In addition to OMS 6I4, traffic shall be maintained in accordance with the following requirements.
2. The purpose of the following requirements for traffic control for pavement marking operations is to provide safety for highway users, workers and equipment and to protect the markings from damage during application.
3. These requirements are the minimums. If at any time during the application of markings it is found by the Engineer that these minimum traffic control requirements are not achieving the necessary safety and marking protection, additional traffic control shall be implemented at no additional cost.
4. The Engineer may suspend work in order to relieve traffic congestion at any time.
5. No work shall be done during peak hours or during any other times which would result in excessive queuing, as determined by the Engineer.
6. Vehicles transporting flammable pavement marking materials shall be equipped with a TMA. The TMA must bring the vehicle to a safe, controlled stop, per Supplemental Specification 921 “Arrow Boards.”
7. When called for in the plans the shadow vehicle(s) shall be equipped with a TMA. The TMA must bring the vehicle to a safe, controlled stop, per Supplemental Specification 921 “Arrow Boards.”
8. During nighttime conditions the following traffic control shall be provided:
   a) Cones shall be reflectorized or equipped with lighting devices for maximum visibility (see OMUTCD).
   b) The guide and side-mounted carriages shall be illuminated.
   c) Arrows shall be illuminated.
9. The presence of highway lighting does not waive these requirements.

IMMOBILE OPERATIONS
3A. When loading material, cleaning or performing other operations in the field, every effort shall be made to have all equipment completely off of the traveled way.
3B. When it becomes necessary to enter upon private property, permission shall be obtained in advance.
3C. When the Contractor cannot remove his equipment from the traveled way, all traffic control devices on the vehicles shall be to operation, flaggers and vehicles shall be stationed to protect the work site and the traveling public.
3D. Two-way traffic shall be maintained.
3E. Flaggers shall be equipped in accordance with OMS 6I4.

Auxiliary Markings
4. Pavement preparation and placing of auxiliary markings are considered to be stationary operations and traffic control shall be in accordance with plan details, standard construction drawings and the Ohio Manual of Uniform Traffic Control Devices (OMUTCD).

Nighttime Operation
5A. Nighttime operation is defined to include the time from sunset to sunrise, and at any other time when there are unfavorable atmospheric conditions or when there is not sufficient natural light to render discernible persons, vehicles, and substantial objects on the highway at a distance of 1000'.
5B. During nighttime conditions the following traffic control shall be provided:
   a) Cones shall be reflectorized or equipped with lighting devices for maximum visibility (see OMUTCD).
   b) The guide and side-mounted carriages shall be illuminated.
5C. The presence of highway lighting does not waive these requirements.

Special Roadway Construction Drawing
6A. A Type B arrow board shall be from the DOT approved list. For more information, refer to Supplemental Specification 921 “Arrow Boards.”
6B. Arrow boards, when used on two-lane, two-way roadways shall be displayed only in the caution mode.
6C. When not in use, arrow boards shall be tilted horizontally or covered.
6D. The WET PAINT - KEEP OFF (R11-H6-24) signs shall be placed facing traffic as follows:
   a) The beginning and end of line application, bi All side and cross roads, and
   b) Maximum intervals of one mile.
6E. Line marking machines shall not be used for sign and cone placement.

CONE AND WET PAINT - KEEP OFF SIGNS
2A. Cones and WET PAINT - KEEP OFF (R11-H6-24) signs shall be placed to protect the line wherever the track-free time exceeds 2 minutes.
2B. These devices shall not be removed until the line has dried to a track-free condition.
2C. Retrieval equipment shall have the traffic control equipment of a shadow vehicle.
2D. Cones shall have a minimum height of 28”.
2E. Cones shall be spaced at a maximum distance of 200' to protect the wet line, in areas of traffic congestion, on curves, and at other locations where tracking of the wet line is expected, closer spacings may be required.
2F. The WET PAINT - KEEP OFF (R11-H6-24) signs shall be placed facing traffic as follows:
   a) The beginning and end of line application, bi All side and cross roads, and
   b) Maximum intervals of one mile.
2G. When line markings require greater than a two minute drying time or when the actual field conditions exceed two minute drying time, the lane from which the line marking machine applies line markings shall be closed until the line has dried to a totally track-free condition.

Truck-Mounted Attenuator (TMA)
7A. When called for in the plans the shadow vehicles shall be equipped with a TMA. The TMA must bring the vehicle weighing about 1800 to 4500 pounds and traveling at 50 mph to a safe, controlled stop, per NCHRP 350 criteria.
7B. A shadow vehicle with TMA should be used in accordance with manufacturer’s specifications and must meet NCHRP 350 with acceptable written manufacturer certification submitted to the Engineer before the devices are used on the project.
PAVEMENT MARKING VEHICLES AND EQUIPMENT

LEAD VEHICLE
6A. A lead vehicle shall be used to warn opposing traffic of the approach of center line and other marking equipment when this equipment extends into the adjacent opposing traffic lane.

6B. The lead vehicle shall precede the "left-to-center" marking equipment a distance that will provide advance warning to approaching traffic.

6C. The operator of this unit shall drive ahead of the crest of a vertical curve or around a horizontal curve and hold until the "left-to-center" marking equipment nears and then proceed, maintaining an advance location of 400' to 600'.

6D. A lead vehicle shall be equipped with the following traffic control devices:
   a) A high-intensity yellow rotating, flashing, oscillating, or strobe light(s), clearly visible a minimum of one quarter mile.
   b) Lighted headlights and tailights, and
   c) A KEEP RIGHT (W24-H4-48) sign and WET PAINT (W24-H3-48) sign mounted a minimum of 5' above the road surface, measured to the bottom of the sign, and visible to opposing traffic.

POWER BROOM EQUIPMENT
9. Power broom equipment shall be equipped and operated during pavement preparations with the following traffic control devices:
   a) A high-intensity yellow rotating, flashing, oscillating, or strobe light(s), clearly visible a minimum of one quarter mile.
   b) Lighted headlights and tailights, and
   c) A Type B arrow board, displayed to the rear, mounted a minimum of 5' above the road surface measured to the bottom of the sign, and visible to opposing traffic.

VEHICLE FOR LAYOUT AND PREMARKING
10. The vehicle used in layout and premarking shall be equipped with the following equipment:
    a) A high-intensity yellow rotating, flashing, oscillating, or strobe light(s), clearly visible a minimum of one quarter mile.
    b) Lighted headlights and tailights, and
    c) A KEEP RIGHT (W24-H4-48) sign and WET PAINT (W24-H3-48) sign mounted a minimum of 5' above the road surface measured to the bottom of the sign, and visible to opposing traffic.

LINE MARKING MACHINE
11A. All traffic line marking machines shall be equipped and operated with the following traffic control equipment:
    a) Three high-intensity yellow rotating, flashing, oscillating, or strobe light(s), clearly visible a minimum of one quarter mile, one facing each on the right rear and one on the left rear of the vehicle.
    b) A type B arrow board, displayed to the rear, mounted a minimum of 5' above the road surface, measured to the bottom of the board.
    or
    2) A DO NOT PASS (R11-H7-48) sign visible to the rear during center line marking on two-lane, two-way roadways and mounted a minimum of 7' above the road surface, measured to the bottom of the sign, this sign may be used to cover the arrow board when used on two-lane, two-way roadways.

11B. A WET PAINT with Arrow (W24-H24-24) or W24-H24-48 sign shall face the rear as follows:
    a) The sign shall be positioned with the arrow pointing to the wet line.
    b) When used, a W24-H24-24 sign shall be mounted on the side of the vehicle nearest the wet marking material.
    c) W24-H24-24 and W24-H24-48 signs shall be mounted a minimum of 10' above the road surface, measured to the bottom of the sign.

11C. A KEEP RIGHT (W24-H4-48) sign and WET PAINT (W24-H3-48) sign mounted a minimum of 5' above the road surface, measured to the bottom of the sign.

11D. The guide and driver-mounted marking carriages shall each be equipped with a clean red flag not less than 24" square and fastened to a staff of sufficient length so as to permit the flag to move freely of any obstruction.

SHADOW VEHICLE
12A. When required, a shadow vehicle shall be positioned at the track-free end of the wet line.

12B. A LEAD VEHICLE shall be equipped with the following equipment (Also see SHADOW VEHICLE):
    a) A Type B arrow board, displayed to the rear, mounted a minimum of 5' above the road surface measured to the bottom of the sign.
    or
    b) A WET PAINT with Arrow (W24-H24-24) or W24-H24-48 sign mounted a minimum of 5' above the road surface, measured to the bottom of the sign.

TABLE OF TRAFFIC CONTROL EQUIPMENT REQUIREMENTS

This table indicates the traffic control equipment which shall be furnished for each type of line pavement marking operation. In addition, the types of traffic control marking equipment shall be furnished when directed by the Engineer.

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For equipment requirements for auxiliary marking operations see the plans and SDOTSD Part 4.

This table indicates the traffic control equipment which shall be furnished for each type of line pavement marking operation. In addition, the types of traffic control marking equipment shall be furnished when directed by the Engineer.

1. Required equipment

2. Equipment required when directed by the Engineer

3. Not required

4. Required equipment for sign and cone placement

5. For equipment requirements for auxiliary marking operations see the plans and SDOTSD Part 4.

6. Includes both dashed and solid lane lines.

7. Channelizing line segments of 200' or less shall be considered auxiliary markings, except when applied as components of gore markings applied in moving operations separate from the application of transverse lines.

8. Includes both dashed and solid lane lines.

9. Channelizing line segments of 200' or less shall be considered auxiliary markings, except when applied as components of gore markings applied in moving operations separate from the application of transverse lines.
NOTES:

GENERAL

1. This drawing presents delineation procedures for crossovers or lane shifts. The procedures for transitional areas apply to crossovers and to lane shifts of 4' or greater. Delination of transition areas for shifts of less than 4' shall be as per the tangent area delineation.

2. All materials furnished shall be listed on the Department's Prequalified Lists.

3. The geometry of the crossover or lane shift shall be as shown in the plans. Additional details are provided in Standard Construction Drawing (SCD) MT-95.10.

4. See SCDs MT-102.10 and MT-102.20 for more details concerning lane shifts.

5. The snow-plowing season shall be from October 15 through March 31 or as otherwise specified in the plans.

LEGEND

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPM</td>
<td>Raised Pavement Markers (RPM)</td>
</tr>
</tbody>
</table>

PAVEMENT MARKING

6. Raised Pavement Markers (RPMs) shall meet the following seasonal specifications:
   a) RPMs on permanent concrete surfaces shall be 614 Work Zone Raised Pavement Markers (WZRPMs).
   b) The WZRPMs on permanent concrete surfaces are intended for use only during the non-snow-plowing season. WZRPMs shall not be placed during the snow-plowing season. Where a temporary pavement marking will remain in use through the winter, the RPMs shall be removed prior to the beginning of snow-plowing season and reinstalled approximately April 4, or as otherwise determined by the Engineer.
   c) RPMs on asphalt surfaces and temporary concrete surfaces during the normal construction season may be either 621 Raised Pavement Markers or 614 Work Zone Raised Pavement Markers (WZRPMs). The normal construction season shall begin on January 1 and end on December 31. RPMs shall be the period from April 1 through October 15.
   d) On asphalt surfaces and temporary concrete surfaces where it is intended that work will continue beyond October 15 but will be completed prior to the beginning of snow-plowing season, 614 Work Zone Raised Pavement Markers may remain in place until such time. If project delays, not the fault of ODOT, cause work to extend into the snow-plowing season, the Contractor shall be responsible for replacing WZRPMs with 621 Raised Pavement Markers, as determined by the Engineer, at the Contractor's expense.

7. Spacing of RPMs shall be:
   a) 20' center-to-center for all long-line marking within transition areas.
   b) Within tangent areas RPMs shall be placed only along the lane lines, spaced at 120' center-to-center.
   c) On asphalt surfaces and temporary concrete surfaces, the RPMs shall be 1-way, facing oncoming traffic, and shall be white or yellow to match the color of the associated line marking.
   d) On asphalt surfaces and temporary concrete surfaces where it is intended that RPMs will winter over, 614 Work Zone Raised Pavement Markers shall be provided. Replacement of 614 Raised Pavement Markers shall be at the Contractor's expense.

8. RPMs shall be white, facing oncoming traffic, and shall be white or yellow to match the color of the associated line marking.

9. Along the edge lines, the RPMs shall be offset a maximum of 4' to the outside of the lines. Along the channelizing lines, the RPMs shall be offset to the left of the lines by no more than 4'. Along the lane lines the RPMs shall be centered between dashes.

10. Installation of RPMs shall begin as soon as possible following the pavement marking installation through the shift area and shall be completed within 3 calendar days with the approval of the Engineer.

11. The RPMs shall be removed when they are no longer appropriate.

12. Holes resulting from removal of 621 Raised Pavement Markers shall be filled as per 621.08. If removal of the 621 Raised Pavement Markers does not take place immediately after the temporary alignment becomes invalid, the reflectors within the 621 Raised Pavement Markers shall be filled as per 621.08. If project delays, not the fault of ODOT, cause work to extend into the snow-plowing season, the WZRPMs shall not be provided during the snow-plowing season.

13. Following removal of 621 Raised Pavement Markers, resurfacing of the transition shall be performed. The new pavement marking shall be painted at the time the surfacing is being applied. In preparation for resurfacing, the existing pavement marking shall be removed to a depth necessary to reach the level of the intermediate course of the proposed pavement.

WORK ZONE DELINEATION FOR Crossovers OR LANE SHIFTS
# DROP-OFFS IN WORK ZONES

**CONDITION I**

DROP-OFFS BETWEEN ADJACENT TRAVELED LANE(S) / PAVED SHOULDER

- Freeways, Expressways, other Roadways ≤ 40 mph

These treatments are to be used for resurfacing or pavement planing, etc. where a drop-off is located between or within traveled lanes and/or shoulder.

<table>
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<tr>
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<td>≤ 45°</td>
<td>Erect W8-11 or W8-9 sign as appropriate.</td>
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## OPTIONAL WEDGE TREATMENT

### WELDING OR RESURFACING

1. W8-9/W8-11 sign shall be used as appropriate.

2. This treatment shall not be used where a hot longitudinal joint per CMS 446 is required.

3. While the need for certain advisory signing is noted herein, it is not intended that this be indicative of all signing that may be required to advise or warn motorists, and all requirements of the Ohio Manual of Uniform Traffic Control Devices (OMUTCD) must be fulfilled.

4. Where the plans do not provide specific items for labor, equipment, materials, or incidental costs to provide and subsequently remove the pavement edge, they shall be included and paid for under the lump sum bid for CMS 614 - Maintaining Traffic.

## NOTES:

1. It is intended that this drawing be used for treatment of drop-offs that develop during construction operations and that are not otherwise provided for in the construction plans.

2. Minimum lane widths shall be 10' unless otherwise specified in the plans.

3. In urban or otherwise heavily developed areas where intersections, driveways, pedestrians, and bicyclists may be present in significant numbers, additional signing and protective measures other than those shown herein may be required.

4. The drop-off treatment selected for use at any given location shall be as appropriate for the prevailing conditions at the site.

5. Where portable barrier is specified, it shall be in accordance with SCD RM-4.1 or 4.2 and with CMS 622.

6. Pavement repairs or scarifying work at lengths greater than 60' - utilize appropriate treatment from Condition I.

## Condition II

### DROP-OFFS BEYOND EDGE OF TRAVELED LANE (Freeways, Expressways, other Roadways > 45 mph and minimal driveways)

1. The conditions indicated below are for use in conjunction with resurfacing, planing, or excavations located beyond the edge line of the traveled lanes.

2. The treatments indicated below are applicable for pavement/shoulder drop-offs and for locations where foreslopes ≥3:1.

3. Where the drop-off is located outside the clear zone, no treatment is necessary (see Table II and SCDs MT-95.30, 95.40, or 102.10).

4. Where foreslopes ≥3:1 or flatter, no treatment is necessary.

## CONDITION III

DROP-OFFS BEYOND CURB WHERE Curb IS 6' OR GREATER IN HEIGHT AND THE LEGAL SPEED IS 40 MPH OR LESS

1. It is intended that this drawing be used for treatment of drop-offs that develop during construction operations and that are not otherwise provided for in the construction plans.

2. Where the plans do not provide specific items for labor, equipment, or materials to implement the drop-off treatments specified herein, they shall be included and paid for under the lump sum bid for CMS 614 - Maintaining Traffic.

3. Where foreslopes ≥3:1 or flatter, no treatment is necessary.

4. Where the drop-off is located outside the clear zone, no treatment is necessary (see Table II and SCDs MT-95.30, 95.40, or 102.10).

5. Where portable barrier is specified, it shall be in accordance with SCD RM-4.1 or 4.2 and with CMS 622.

6. Where the drop-off is located outside the clear zone, no treatment is necessary.

7. For locations such as at ramps, lane shifts, lane closures, etc., all labor, equipment, materials, and incidental costs to provide and subsequently remove the pavement edge shall be included and paid for under the lump sum bid for CMS 614 - Maintaining Traffic.

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